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ma Pacific Dental Congress

VOL. I.

Panama Pacific International Exposition

Charles C. Moore
President of Exposition

1915

James A. Barr
Director of Congresses

Transactions

of the

Panama Pacific Dental Congress

held at

San Francisco, Cal., U. S. A.

August 30 to September 9, 1915

Edited for the Committee of Organization

By R. OTTOLENGUI, D.D.S.

In Three Volumes

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FRANK L. PLATT—PRESIDENT OF THE CONGRESS

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History of the Organization and Promotion of the Panama Pacific Dental Congress.

By Dr. Frank L. Platt

ON January 10, 1910, at a meeting of the San Francisco Dental Association, a resolution was adopted, providing for the appointment of a com- ɔ take the initial steps toward a dental congress, international cter, in San Francisco, during ɔd of the Panama Pacific Inter- Exposition, and appropriating of one hundred dollars to meet ɜnses of the committee in the e of its duties.

ıe February meeting of the he personnel of the committee ounced as follows:

nan, Dr. W. A. L. Knowles; s, Dr. Frank L. Platt, Dr. Guy ɜerry, Dr. James G. Sharp and rles E. Post.

:ommittee met at various times during 1910 and 1911 to devise ways and means for promoting the congress and finally called a convention of delegates representing the dental societies of Oregon, Washington, Idaho, Colorado, Utah. Arizona and California, to form a representative committee of organization to promote the interests of the congress.

This convention met on March 14, 1912, adopted by-laws, and elected officers as follows: Dr. Frank L. Platt, Chairman; Dr. Arthur M. Flood, Secretary; Dr. W. A. L. Knowles, Treasurer.

It was decided that these officers, with twelve directors, constitute the officers and board of directors of the committees. Of the twelve directors, five were to be chosen from the members of the profession residing near San Francisco to facilitate securing a quorum at meetings of the committee, one from Southern California, and one from each of the Pacific Coast States represented in the convention. These directors were to be elected by the dental societies of their respective States.

Drs. H. G. Chappel, J. L. Pease, Fred G. Baird, R. B. Giffen and A. M. Barker were elected to the directorate.

Reports of several sub-committees of the original committee were read and discussed, the membership fee was fixed at ten dollars, and it was voted that the organization incorporate in order to facilitate the transaction of business.

The delegates to the convention and the original committee of organization having performed the duties entrusted to them, passed out of official existence and the Committee of Organization of the Panama Pacific Dental Congress assumed full control of the destinies of the organization.

At the first meeting of the Committee of Organization, committees were appointed on revision of by-laws and incorporation whose reports were adopted at later meetings. On the advice of the attorney for the board, it was decided that the corporation to be formed consist of only five members rather than the whole committee of organization, that it have a distinctive title and have

full control of the finances of the congress. In pursuance of this plan, the incorporation of the Pacific Dental Congress Commission of 1915 was effected with the following officers: (Dr. W. A. L. Knowles resigning as Treasurer of the Congress and declining to serve as Treasurer of the Commission); Dr. Frank L. Platt, President; Dr. Arthur M. Flood, Secretary; Dr. Fred G. Baird, Treasurer, and Dr. R. B. Giffen and Dr. Joseph Loran Pease.

The adoption of the plan of incorporation abolishing the office of Treasurer of the Committee, the office of Vice-Chairman was created in order to maintain the required number of officers and provide for emergencies and Dr. W. A. L. Knowles was elected Vice-Chairman of the Committee of Organization.

The only stock issued was one share to each member of the corporation, which, under its charter, was empowered to issue three thousand debenture bonds of the value of ten dollars each. The funds derived from their sale are to be used to promote and finance the congress with the understanding that when the duties of the corporation are performed, its debts paid and the congress closed, any sum remaining in the treasury shall be divided pro rata among the holders of the debentures. In order to bring these matters to the attention of the profession, a mass meeting was held in San Francisco, April 29, 1912, at which time the purposes of the Committee of Organization and the Corporation were explained. At this meeting twelve memberships in the congress were taken and two thousand one hundred and thirty dollars subscribed for debentures.

At a meeting of the committee held on August 17, 1912, Dr. Frank L. Platt and Dr. A. M. Flood were appointed delegates to attend the meeting of the National Dental Association at Washington, D. C., and were instructed to invite that organization to adjourn its regular 1915 meeting to meet with the Panama Pacific Dental Congress in San Francisco. This invitation was accepted and the congress given most substantial encouragement by the National Association. To carry out the general plan of publicity of the congress, executive committees were appointed in practically every State and country in the world, their duties being to bring the congress to the attention of their State and local societies, and secure memberships and contributions to program. The dentists of the State of Colorado failing to take an active part in the organization and having elected director, Dr. H. A. Fredrick, of S Francisco, was elected a Director member of the Committee of Org zation. At a meeting of the comm held in Oakland, Cal., June 4, 1913 question of the election of perm officers of the congress was disc and it was determined in view unpleasant circumstances attendi election of officers of the Fourth national Congress held at St. Mo., that such an election be once. The following officers were then elected. President, Dr. Frank L. Platt, San Francisco, Cal.; Vice-President, Dr. Chas. M. Benbrook, Los Angeles, Cal.; Secretary, Dr. Arthur M. Flood, San Francisco, Cal.; Treasurer, Dr. Fred G. Baird, San Francisco, Cal.

At the meeting held on August 30, 1913, the resignation of Drs. Knowles and Barker were accepted and Dr. C. F. Jarvis, of Oakland, Cal., and Dr. T. Sydney Smith, Palo Alto, Cal., were elected to succeed them, and Dr. Arthur W. Chance, of Portland, Ore., was elected Vice-Chairman of the Committee of Organization. A vast amount of correspondence has been carried on by the committee in securing exhibits, memberships and program for the congress, but the results obtained seem to

have justified the expense and labor involved.

The dental journals of the world have been most generous in giving their pages for the publication of data relating to the congress and have promoted its interests quite materially. Manufacturers and dealers everywhere responded to the invitation to exhibit at the congress and gave it their generous support. The officers and members of the executive committees and of the sections into which the congress was divided labored long and earnestly to make its sessions notable, and the record in these transactions tells the story of their success. This history from necessity is brief. It embodies but an outline of the work of the various committees of the congress but is printed in the hope that it will suffice and in the knowledge that it, unlike some histories—so far as it goes—tells the truth.

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Rules Governing Officers of Sections, and State and National Executive Committees

Rules governing the Officers of Sections and Chairmen and Members of State and National Executive Committees of the Panama Pacific Dental Congress, held in San Francisco, California, August 30 to September 9, 1915.

Rule I

The Officers of each Section shall constitute the Board of Censors for that Section.

Rule II

The Officers of each Section shall cooperate with State and National Executive Committees in securing Papers and Clinics for the Program of the Congress, and also with the Program and Clinic Committees.

Rule III

The Officers of each Section and the Chairmen and Members of State and Executive Committees are empowered to solicit and receive from legal and reputable practitioners of dentistry and medicine, and persons proficient in the allied sciences, papers and clinics on subjects of interest to the Congress, it being understood that each essayist or clinician is an authority on, or particularly well qualified to deal with, the subject presented.

Rule IV

The Chairman of each Section is invited to deliver an address before his Section, not to exceed twenty minutes in length; this address to constitute one of the papers of that Section.

Rule V

The aggregate number of papers accepted shall not exceed ten for each Section, and not more than two-fifths of those accepted may be read by title.

Rule VI

Papers may be read and discussed before the Congress in any langu: copies of all papers, or summ: papers, and discussions, typewr the English language, ready fo ing, must reach the Progran mittee in San Francisco not la May 1, 1915.

Rule VII

Each paper and discussion printed in full in the publishe actions of the Congress, but a m of twenty minutes only will be for the reading of a paper, or mary of it, embracing its leadin in case the reading of the original would occupy more than the allotted time, and five minutes for each speaker taking part in the discussion; not more than fifteen minutes will be allowed for the discussion of any paper, and the author will be allowed five minutes in closing the discussion.

The author of each paper is requested to furnish the Secretary of the Section to which his paper belongs with the names and addresses of those who will discuss his paper.

Rule VIII

No clinic will be given a place on the Program of the Congress unless a

concise description of it, typewritten in the English language, ready for printing, reaches the Clinic Committee in San Francisco on or before May 1, 1915.

Rule IX

State and National Executive Committees are governed by the rules governing the Officers of Sections, so far as they apply. Note particularly Rules II, III, V, VI, VII and VIII; also

Rule X

Each contribution to the Program, either paper or clinic, shall be sent promptly to the Chairman of the Section to which its title indicates it to belong. In case of doubt, it shall be sent to the office of the Committee of Organization in San Francisco, this Committee determining its place on the Program.

Rule XI

In the event of any controversy arising between Contributors and the Officers of any Section the question at issue shall, at the discretion of the Officers of the Section, be submitted to the Committee of Organization for final adjustment.

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First Lieut. Frank H. Wolven, Dental Surgeon, U. S. A. ....Fort McDowell, Cal.
First Lieut. G. S. Casaday, Dental Surgeon, U. S. A. ....Presidio, San Francisco
First Lieut. J. R. Bernheim, Dental Surgeon, U. S. A. .....Fort Logan, Colo.
C. G. Baker, Acting Dental Surgeon, U. S. A. ....Fort Adams, Philippine Islands

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Representative of the United States Navy Dental Corps

William L. Darnall, D.D.S., U. S. N., U. S. Naval Training Station,
San Francisco, Cal.

Representative of the United States Indian Service

F. E. Rodriguez, D.D.S., Indian School .....Albuquerque, New Mexico

Opening Ceremonies

Held in Main Assembly Room, Civic Centre

August 30th, 1915

Opening Ceremonies.

The opening ceremonies of the Panama-Pacific Dental Congress were held in the main assembly room at the Civic Center, San Francisco, California, at 3:30 P. M., August 30, 1915.

The Honorable James A. Barr, Director of Congresses, requested that all the honorary vice-presidents and the representatives of foreign nations take their seats upon the platform.

Hon. James A. Barr. Members of the Panama-Pacific Dental Congress, Ladies and Gentlemen: The first steps for the organization of the Panama-Pacific Dental Congress were taken more than five years ago. So far as the records show, this was the first of the exposition congresses even to be thought of. In fact, the first steps leading to the present congress were taken two years before the exposition organized its general congress program, a program which now includes eight hundred and seventy-five congresses and conventions. In June, 1912, more than two years ago, the organizing committee asked for a definite assignment of this and other halls to be used for sessions and for exhibits. The hall reservations then made were the first reservations made in this auditorium for any congress or convention (applause). The reservation was made, as I remember it, shortly after the cornerstone of the building was laid. I mention these facts as typical of the forethought and careful preparation of the Organizing Committee in developing plans for the Congress.

While it is not my province to-day to make any extended remarks, I do want to express my appreciation of the splendid service that has been rendered by the Organizing Committee and other committees of this Congress.

No Congress of the eight hundred and seventy-five to be held under the auspices of the Exposition, better typifies the spirit of a general congress program. The central thought underlying all the congress programs is service; social, educational, industrial and professional service. The program beginning to-day with its illustrative exhibits, will spell service to the dental profession.

One of the most distinctive phases of the work of arrangement for an exposition series of congresses and conventions is the so-called grouping plan. Under this plan, all of the national and state units of each group have met within periods ranging from one to three weeks. We have had periods devoted to education, science, medicine, history, agriculture, geneology, economics, the press, and other lines of thought, and to-day marks the beginning of one of the best organizations of these periods, the dental period, including this congress with its affiliated bodies.

Another distinctive phase of our work has been the effort made to bring the congresses in touch with the Exposition and special exhibits illustrative of the several programs. I need but mention the exhibits in the other halls, to show how well the Organizing Committee has developed this plan.

It remains for others to extend an official welcome. As director of Congresses of the Panama-Pacific International Exposition it gives me very great pleasure formally to declare the Panama-Pacific Dental Congress opened, and to introduce your President, Dr. Frank L. Platt. Ladies and gentlemen of the Congress, Dr. Platt. (Prolonged applause.)

Pres. Frank L. Platt. Mr. Barr, Honorary President and Members of the Panama-Pacific Dental Congress, Ladies and Gentlemen: We had hoped to-day to have with us the first man of the State of California, but this is a strenuous age, and a strenuous State, and Governor Johnson is unavoidably unable to be present, but I take great pleasure in introducing to you a member of the State Exposition Commission of California, a gentleman known to many of you, who will speak for the Governor of California and the State. I take great pleasure in introducing to you, Mr. Arthur Arlett, the representative of the Governor of California. (Applause.)

Mr. Arthur Arlett. Mr. Chairman, Ladies and Gentlemen: The diffidence that any man feels when he arises as a substitute is mine, and to-day you can appreciate that that diffidence and reticence is magnified when I attempt to stand in the place of a man who has so large a place in our State and so-increasingly large a place in our nation.

However, it seems to me that under his commission and with his consent, I may attempt at any rate to express to you the greeting that we have here in California for you people in these congresses, who have assembled in this, our year of high privilege, in this city, that we delight to feel is, during this year, the center of the world. For men and women of every variety of thought and activity, people of every interest that might possibly challenge the intellect and activity of humanity, are

making of our city this year a rendezvous, and are finding herein people of like thought, and we believe in the citizens usually of this city and this State, appreciative and sympathetic companions.

I was about to say that there is another measure of diffidence in my appearing, for I discovered as I came down the aisle that my own family dentist is here, and I have not paid him that last bill. (Laughter.) I acknowledge that I owe it, and he has all of you for witnesses that I propose to owe it just as long as you are in the habit of being owed. (Renewed laughter.)

Seriously, we have been doing something in this State for some years past, in the preparation of an exposition. Over there on the shore where the Golden Gate swings in and out with the tide, we have been building, as far as man can build, a city of beauty and of dreams, and as you come here in this, our festival year, with your contribution of thought and of service, we hope that as you come to meet the challenge of its beauty and to feel the ministry of its contribution to your thought-life, that you will feel not strangers, not even, if you please, visiting friends, although we trust that you will have that feeling; but that you will believe that in the aspiration of our citizenship, we have attempted to build there, not only that which challenges your view, but that in dome and spire, in column and cornice, in whatever beauty of pigment and color you see, in the artistry and the work of the artisans, you will likewise find perhaps that better thing we have tried to be and say; and your coming to us we hope is in appreciation of the fact that you, with all the other men and women from our land and other lands, who have made this year possible, are coming, not only as visiting friends, and certainly not as strangers, in the Gate, but as partners together in a great enterpise. For what have we been attempting to say in this year of terrible history, in these months of shocking events? We have been trying to say that in spite of that dread reality, there is a finer and a fuller expression of the race's aspiration, and that in the quiet domestic parts of peace is humanity's richest striving.

And so, we welcome you because we feel that the key-note of all that which you render is service; so as partners in the great task, as fellow companions on a common road, as those who seek to make here and now that fine, fair, thing that the Creator dreamed of when He breathed into man the breath of life, that we all, together, seeking to serve, desiring to know, shall make here, under God, a better civilization of brotherly men. To such an opportunity, to no less a challenge, California says to you, "Welcome." (Applause.)

President Platt. It now becomes my pleasure to introduce to you the Hon. Frank L. Brown, Member of the Board of

Directors of the Exposition, who will speak officially for President C. C. Moore, and the Exposition.

Hon. Frank L. Brown. Mr. President, Ladies and Gentlemen: On behalf of President Moore and the Board of Directors of the Panama-Pacific International Exposition, it gives me great pleasure to welcome you here to-day.

I have been reminded by the Director of Congresses, Mr. Barr,—and in passing I wish to pay a high tribute to the genius of that man who in common with the other members of his committee has been successful in bringing more congresses to this Exposition by many times than any other previous exposition in the world's history; and I believe that we owe to you good people also an added debt of gratitude from the fact that your organization was the very first, and I believe the only convention to adopt the name "Panama-Pacific." (Applause.) Also, our local committees are entitled to the credit of having started this great convention of yours more than five years ago, and having been the first to apply for a hall in this great Auditorium long before it was built, and possibly while it was yet only a dream of the Exposition.

So that I am reminded of a little story that they tell of one of our famous playwrights, who was asked by one of the leading actors if the play that he was writing was up-to-date. And his reply was characteristic. He said, "It is up to to-morrow." And so I think you good people are "up to to-morrow." And if in your profession you are successful in being up to to-morrow, as you certainly have been in the organization of this convention, then the public and the human race will owe you a deep and lasting debt of gratitude, the same as the Exposition now owes you and endeavors to express to you.

Seriously my friends, we of the Exposition have wanted the opportunity of taking into our confidence, so to speak, our visiting guests and friends at these various conventions. You all, of course, have heard somewhat of the Exposition, but its real and deeper purposes I think have not been forced upon your vision. The facts of the case are that this great Exposition was not alone to commemorate the building of the Panama Canal, the greatest engineering achievement of all ages, but also it was a thankoffering for the re-building of the City of San Francisco that only nine years ago was laid in ruins. And as I stepped into this beautiful building to-day I looked at the remnant of our old City Hall, and with it came the vision of April 18, 1906 and the three days and three nights following when this entire city, from Van Ness Avenue to the Harbor was one great mass of flames, and I appeal to you my friends and ask if this beautiful Exposition of ours is not a thankoffering of the people of

San Francisco for the re-building of the city loved around the world, and also a commemoration of the work of American genius in the building of that Canal, the land divided and the world united. And so we had this great purpose to produce a thankoffering for the re-building of our city, and for the fact that American genius and American money and American power were the mighty forces that have at last united the great oceans, and is the force that is to mark in coming centuries what is undoubtedly the most momentous event in the history and commerce of the world.

And it was largely with those thoughts in mind that we invited you, friends to come from all parts of the world, not alone to see our great Exposition, not alone to behold the re-building of our city, but to join with us in thanksgiving and gratitude to the great Giver of all good, that in His wisdom He made it possible for the people of San Francisco to re-build their city, for the people of America to build the Panama Canal.

We feel that the most important event in connection with this Exposition will undoubtedly be the record of the congresses and conventions, because the people who come to these congresses and conventions are all people who stand in the forefront of their respective professions. They are men who have made a name for themselves in the world, men who have stamped their individuality upon the localities from which they come, and it is to record those achievements that we of the Western Coast have contributed to the uplift of this nation that we have asked you men and women of this convention to carry our message back to our friends in the East and in the West and to tell them that the message that we gave to the world five years ago, at the time when you people were first organizing this great convention; the message that we sent, which was echoed throughout the world, was that the West always makes good. And we ask of you friends in giving you our greetings, and in expressing to you our gratitude for your holding of this great convention here to-day, a convention that will mark what we believe is the most important event in the honored profession that you dignify by your presence here to-day; we ask that in accepting our message of gratitude, you carry with you to your home places in the world, the message that San Francisco and the Pacific Coast welcomes the world here to our celebration at the shores of the Golden Gate. (Applause.)

President Platt. I was told a few minutes ago that the Mayor of San Francisco, the Hon. James Rolph, had been detained in court. I was not informed what he had been doing; but at any rate he cannot be with us to-day, much as I know he would like to be here; and I am quite confident that if he is detained in court he is trying to do something for the good of San Fran-

cisco. (Applause.) But his Secretary is here and will speak for the Mayor and the City of San Francisco. I take great pleasure in introducing Mr. Edward Rainey, Secretary to the Mayor. (Applause.)

Mr. Edward Rainey. Mr. President and Friends: I am experiencing a very considerable amount of embarrassment in coming over here this afternoon to speak to all of you, because it was only a very few minutes ago that I knew I would have to come at all. We have been having for a long while a kind of a siege with the United Railroads which used to be a railroad monopoly in San Francisco before our beautiful Municipal Car Line cars were built; and the United Railroads is trying to put the Mayor of San Francisco in jail for running some of those municipal cars, which the United Railroads does not like to see on the streets of San Francisco; and we are fighting it out this afternoon, and the lawyers are making endless speeches about whether the Mayor should go to jail or whether he should come over here. (Laughter and applause.) And of course, the Mayor did not care to take the risk of standing here on this platform and having some one slip around at his side and tap him on the shoulder and say, "You have got six days"; for that would have been a very unwelcome announcement, and it would have disconcerted him in the midst of his speech, so he said, "Mr. Rainey, I will ask you please to go over there and present the compliments of the City of San Francisco to the members of this Congress"; and I said that word which is the most familiar word I presume you men and women ever hear, that very, very expressive word "Ouch!" But I am here, and I will ask you to accept the sincerity of what I have to say, in lieu of the polished oratory that the Mayor himself could have given you, following the example of Mr. Barr of the Exposition, or of Mr. Brown the silver or gold-tongued orator of the Exposition, and of Mr. Arlett, the Representative of the Governor of the State of California.

But as has been said by the other gentlemen, we San Franciscans are proud to have these conventions meet here in this beautiful Auditorium, built by the Exposition and the people of our city. We know that from every convention that meets here there will be some useful results. That is bound to be the result of your convention. You are destined to hear a lot of polished oratory. You are sure to have some people stand on this platform and tell you of things that perhaps do not amount to anything; but some of your men or women will tell the others of you, things that will be of inestimable value to each and every one of you, and those are the things that San Francisco's people are proud to have sent out to the world from the center of our city. That is the reason we are proud to have you here; we are proud to have you here because we know the use-

ful purpose that has brought you together; we are proud to have you here in San Francisco because we know the sincerity of each and every one of you in coming here. You have come here partly for a good time. You can have a good time anywhere, but you can have the best time in the world in San Francisco. But you have come, like all of those other conventions some eight hundred and odd in number, in order that you may advance your profession, that you may communicate to each other the best that any one of you has been able to discover and we are glad to have you do that. In that connection while I was sitting on this platform, I was thinking what would it cost me if you were talking to me, instead of my being up here talking to you (laughter), and I have not yet figured out the appalling answer.

I want to say to you again, and again and again, with all the sincerity that I can, that we are proud to have these good tidings going out from the City of San Francisco, the great results that you have accomplished and which you are accomplishing, in the announcements that are made amongst us of the things you have discovered and of the things you have done. I had luncheon to-day with Dr. White of Santa Barbara, who was my former dentist, and I said to him, "Doctor, what shall I say over there? What are the great accomplishments that the dentists have made in the last few years? Are they in line with all the other professions; which have gone ahead so much that this Exposition is an expression of the world's progress in the last ten years?" And he said, "Just smile when you get up there, and when they see that bridgework that I put in for you they will appreciate fully the progress that has been made in dental work in recent years." (Laughter.)

What has been said about your profession is true of everything. Go to the Exposition and look at the wonderful engines in Machinery Hall; look at the wonderful things in every building over there; look at the wonderful new spirit of determination, and that is the most important thing to my mind over at the Exposition; the wonderful new spirit and the friendship that is manifested between the Latin-speaking races of the Southern part of this world and the people of the United States and Canada; that is the greatest thing. The knitting together of North and South America, which is accomplished over at the Exposition is one of the greatest blessings that has come into this world, and everywhere, through every line of march of civilization, through all the professions, you will find the same accomplishments which you people are going to talk about, and you are in tune with all of them.

In closing, I presume that following the usual formula of these addresses of welcome, I, as the Representative of the people of San Fran-

cisco, of the authorities of San Francisco, should present you with the keys to the city. Will you please consider that they are yours. I am obliged to omit the actual formal presentation of the keys to the Chairman, because to tell you the honest truth we have run out of keys. (Laughter.) But please consider that you are as much at home, that you are as much home folks in San Francisco as the oldest inhabitants. If some of you younger fellows want to go down and sing at Third and Market Streets, "We have gathered at the River"—not, "We shall gather," but "We have gathered"—you are welcome to do that, and if anybody says you "no"—my telephone number is Fillmore 723, and I do not mind being called late at night. But nobody will do anything to you, because San Francisco loves its guests, and I am going to take the liberty of assuring you all over, each and every one of you who has come from some other place, I am going to put you in the hands of the men of your profession in San Francisco. I am going to say that I am willing to let the reputation of San Francisco for hospitality rest on their shoulders, and from now on friends, knowing how welcome you are; you are in the hands of the men of your profession as the guests of San Francisco, and it is up to them. I thank you. (Applause.)

President Pratt. The next speaker is a man needing no introduction to the dental profession of the world; a man known far and near as a joyful, wholesome, sound-minded representative of the dental profession, and the reason we have called upon him to speak to you at this time, is that we wish to demonstrate to all present that there are men in the dental profession who can talk as well in public—or even better, than they can when standing opposite their chairs, no matter how much they are paid for it. I am pleased to introduce to you, Dr. Burton Lee Thorpe, of Saint Louis.

Dr. B. L. Thorpe. Mr. President, Representatives of the State, City and Exposition; Ladies and Gentlemen of the Congress: Surely the strong arm of Western hospitality has encircled us all and I am certain we appreciate your warm and cordial greetings very much, indeed, and consider it a great pleasure to be here to participate in this history making event that ever is to redound to the credit and glory of American dental surgery.

We like this country of yours with its wealth of sunshine, fruit, flowers, fragrance, and wonderful climate. I once knew of an Eastern man, who suffered with hay fever so severely, he sneezed every time he passed a grass widow, but he became cured after moving to California. (Laughter.)

I am told of all the many things that are to the credit of San Fran-

cisco and of this section of California; there is only one objectionable feature, and that is the sand flea, which is known to some of the guests visiting here. I am reminded of the little girl who was walking down the street with her mother, and she said, "Mamma, there is a flea on me!"—and the mother said, "Where, child?" Just then a boy came along hallooing the morning paper, and yelled—"Examiner! Examiner!" (Laughter.)

Some months ago Dr. Platt sent me a beautiful poem, written by Robert Loveman: it went something like this:

It isn't raining rain to me, it's raining roses down.
In every dimpled drop I see wild flowers on the hills,
The clouds of gray engulf the day and overwhelm the town;
It isn't raining rain to me, it's raining roses down.

It isn't raining rain to me, but fields of clover bloom,
Where any buccaneering bee may find a bed and room,
A health unto the happy! a fig for him who frets!
It isn't raining rain to me, it's raining violets."

"This," Dr. Platt said in his letter, "is what you will find when you come to California." Yesterday I asked him about it and he said I was here two months too early!

It is a great pleasure to visit this mighty State whose early days were surrounded with the glamor and poetry of adventure, romance, tradition, legend and the charming chivalry of fact and fancy that enters into the writing of all history, made familiar to us by Bret Harte, Mark Twain, Walt Whitman, Joaquin Miller and Helen Hunt Jackson.

In 1849, the single magic word "Gold" sped eastward across the continent and made California the Mecca and the El Dorado of the world. The gold madness has long since passed, but the steadfast purpose that carried the treasure hunters to the wilderness led their sons to build on that sure foundation the edifice of state and civic greatness.

It has been my observation that the hearts of Californians are filled with the gold of hospitality and love and laughter, and that is the best sort of gold I know of.

It gives us great pleasure to be here to-day to join with our professional *conferers* of this State and of the Pacific Coast States in celebrating this wonderful achievement—The Panama-Pacific Dental Congress, which is a timekeeper of our professional progress.

I thank God to-day our American laymen are daily being educated to the important relation of the teeth to the health, beauty and comfort of

the human race, that adds to life's enjoyment. It has been proven that defective teeth and diseased mouths cause more physical ills than does the demon rum or the pernicious effect of ice water on the human system.

In my school days much space was devoted in the physiologies to the ill effects of alcohol. If equal space is given to diseased teeth and gums, future generations will be a stronger and healthier race, mentally, morally and physically.

Efficiency experts have proven that to diseased mouths is traceable the lack of efficiency of the great majority of our industrial workers.

Social workers have proven that our hospitals, penitentiaries and almhouses are made necessary, and filled to overflowing, because of the mental and physical diseases that find their origin in unhygienic mouths.

A great educational propoganda is being conducted throughout our country and the time is soon coming when appropriations from our national, State and city governments will be made to combat and eradicate mouth diseases.

The time also is soon coming when the people will be led to the baptismal font of modern dentistry—that they may emerge therefrom washed clean of the sin of dental ignorance.

Philanthropists have recognized the great need of mouth hygiene and in three instances have left everlasting monuments to their memory by their munificent benefactions, viz., The Forsyth Brothers, of Boston, Dental Infirmary, for the care of children in dental need. Dr. Thos. W. Evans, Museum and Dental Institute, at Philadelphia, for dental education and research work, and lastly the magnificent gift of Mr. George Eastman, of Kodak fame, in endowing a $1,200,000 Dental Dispensary at Rochester, N. Y., for the care of teeth of the worthy poor.

We appreciate immensely the thoughtful and distinguished consideration shown us by you, the organizers and various committees of the Panama-Pacific Dental Congress, who have each played your rôle so nobly and well, in making possible this great meeting and for the delightful program you have prepared for our social entertainment and professional edification. I give you our sincere and grateful thanks.

To each of you, I give, in behalf of your guests, as the Frenchman would say "accolade"—meaning a knightly salutation.

Dr. Platt. Ladies and Gentlemen: We have other eminent men of our profession, here to-day, and we have imposed on their good nature to the extent of having asked them to address us at this time, and with genuine professional spirit they have all accepted our invitation. I have pleasure in intro-

ducing to you now, Dr. Truman W. Brophy, who will say a few words for the International Dental Federation.

Dr. T. W. Brophy. Mr. President, Ladies and Gentlemen: I feel somewhat embarrassed this afternoon by reason of the fact that some of the orators of my profession have been brought out to address you. This will necessarily make my remarks less interesting. However, I do wish to call the attention of this body—and perhaps to a greater audience than this—to the enormous work that has been done by the International Dental Federation.

In 1900, the United States, through its National Dental Association, saw fit to send delegates to Paris to participate in that great Congress, and there at the close, the International Dental Federation was organized. Some of the nations were rather slow in taking part, but all have since become members. In brief let me say something about what has been accomplished.

The International Dental Federation includes twenty-three representatives of twenty-three nations. These nations are just as much, in the profession, a part of the Federation as the State of California is a part of the United States of America. While we have in this body, advanced rather slowly, this we have done: the great impetus given to oral surgery in this and other countries was inaugurated in the City of Strassburg by Dr. Jessen. Then the work was extended to all the different nations. The great Forsyth Institute of Boston, and more recently the Eastman Institute, to be established in Rochester, N. Y., are practically outgrowths of the work set on foot by Prof. Jessen.

In the armies and navies of the world, by reason of resolutions adopted in the Department of "Army & Navy"—all countries were urged to organize dental corps for the care of the soldiers. Those corps were organized, and as we have here a representative from Spain, I trust he will tell you the Army and Navy of Spain (as in many other countries) insist that the surgeon shall have certain principles of dental pathology well grounded. To-day, in the field, on the other side, there are corps of dental surgeons devoting their time and efforts to the care of the wounded. As you well know, no war ever existed in which there were so many wounded about the head and face. Our confrère, Guilford of Philadelphia, has just returned from Paris, where he has been caring for the wounded.

This organization has made its presence felt wherever dentistry is practiced, and the loyalty and earnestness of the men has made its future secure. Unfortunately, our confreres from the Continent—from England and Europe, are not here: only one man—Dr. Aguilar, of Madrid, Spain,

is here. When I wrote him, and asked if he thought there would be any difficulty in coming, he said he would come if it was necessary for him to come in a canoe! (Loud applause.) He has never missed a congress.

While the service rendered to the poor soldier who is in such dire distress, is rendered freely, there is no distinction in regard to the necessities of suffering mankind. The wounded man, whether he be English, French, Belgian, German, Russian, Turk, Italian, or Servian, is entitled by reason of the fact that he is a brother, to the best of services we are capable of rendering.

I am glad to be here and say a few words, and fear I shall talk too much. But before I sit down I wish to say we will have a meeting here of the Federation. Some of the officers are here, but not the full number. We want all to come. We want the loyalty and support of all the men here, and of all the men who are not here. The representatives of various nations are here, and I am certain they are alive to the work of the Federation. Mr. President, I thank you.

Dr. Platt. Of all the organizations in our profession that have helped to make this Congress a success, and which has contributed largely to our program of papers and clinics—none is more deserving of credit and none has given our committee greater encouragement and hope that the National Dental Association, which shares this meeting this year, coming away out here to San Francisco to become a part of this Congress. It means a great deal to that organization, for the majority of its members cannot be present, and to the majority the year has been forfeited from the activities of the Association; but it is with pleasure that I now introduce to you, Dr. D. M. Gallie, of Chicago, President of the National Dental Association.

Dr. Donald M. Gallie. Mr. President, Distinguished Colleagues, Ladies and Gentlemen: When, three years ago, the President and his associates invited the National Dental Association to come here in conjunction with the Panama-Pacific Dental Congress, some of us who had experience in the tremendous amount of work necessary to successfully carry on a great Dental Congress—knowing that in the past it had required the efforts and the influences of the profession throughout the whole country, some of us had our doubts as to whether you would be able to carry out the wonderful program then outlined to us. But, Ladies and Gentlemen, we forgot that the dentists of the Pacific Coast possess the same blood and the same spirit that was possessed by the early pioneers—the men and women who treked over all the States of this country—over range after range of apparently insurmountable

barriers. They were undismayed when they reached the desert, and after its passage they found still another country, somewhat barren, but through their energy and through their spirit of courage they have made it the most fruitful, perhaps, in all the world.. We forgot that they possess the same building spirit that was possessed by the men and women in this section who were prostrated but a few years ago by the terrible quake and fire, and who, not discouraged, started again and built up this wonderful city. We lost sight of the fact that they are the same people that conceived and created this beautiful Exposition that some of you have seen and of course, all of you will see before you leave the Pacific Coast. It is the most beautiful Exposition that has ever been, and contains buildings the most beautiful ever witnessed by people of either ancient or modern times.

And it is the same spirit that has made this Congress a fact, and which promises to make it one of the greatest Dental Congresses ever held, and Sir, I am sure I am under obligations to you. The National Dental Association appreciates having a part in your deliberations.

We are thankful to your Exposition Officials for a part in this great celebration—the joining of the waters of the Atlantic and the Pacific oceans. The dental profession, as well as humanity, will be benefitted by this Congress. The history of Dental Congresses is, that they broaden our field of vision. They make it possible for us to do a greater work. Like those Congresses that have gone before, the influence of this great meeting will be felt and become a benefit throughout the whole world.

The dentists of America have not been satisfied to rest content with their position as standing foremost in the world of dental affairs. In a measure, in the line of the ways and means, we have been successful, but to our friends in other countries we are indebted for the scientific work they are doing; for the concentrated efforts of our German friends, and for the work of our colleagues in Central and South America. The work we are doing ourselves will make it possible for dentistry to achieve greater things than it has in the past.

As a representative of The National Dental Association, I wish to express our thanks and welcome all of our distinguished colleagues of the International Dental Federation, and those from Central and South America, for joining with us on this splendid occasion; and I am sure when the deliberations of this Congress are over the great good brought out by this gathering will soon be felt throughout the whole world, and the reports of this meeting will prove a forceful factor in a great uplift of humanity, sweeping over this country and over the whole world.

On behalf of The National Dental Association I desire to thank you

for the opportunity of joining with you, and I assure you it is the greatest pleasure of my life to say to you these few words.

Dr. Platt. It now gives me pleasure to turn the proceedings of this meeting over to Dr. Charles M. Benbrook, of Los Angeles, California.

Vice-Pres. Benbrook. We will now have the address of Dr. Frank L. Platt, of San Francisco, President of the Panama-Pacific Dental Congress. (Applause.)

Pres. Frank L. Platt. Nearly six years ago when it seemed more than probable that San Francisco would be selected as the "Exposition City" where would fittingly be celebrated the completion of an undertaking which had been the dream of enterprising men for nearly four hundred years, it occurred to some of the members of our profession that the time, the place and the occasion would be most opportune for holding a Dental Congress; a congress international in character and sufficiently comprehensive in the variety and extent of its program and exhibits to merit for it a place in the general plan of the activities of the exposition.

In conformity with this idea a Committee of Organization was formed representing the dental profession of the Pacific Coast States and under its direction the Congress we inaugurate to-day has been developed.

The work has been arduous and much of it has been in the nature of pioneering for those engaged in it, but national, state and local committees have rendered invaluable aid and have unselfishly performed the tasks assigned them; the officers of the sections into which our program is divided have secured and are ready to present for our pleasure and profit a program of exceptional merit; manufacturers of and dealers in every sort of goods entering into the practice of dentistry have generously provided for our enlightenment a splendid exhibit of their wares; the Panama-Pacific Exposition Company has furnished this great Auditorium for our meeting place, and on behalf of the Committee of Organization I thank them one and all for their interest, support and co-operation.

The general idea of the Panama-Pacific International Exposition is to appropriately celebrate a great achievement, but primarily, and above all else it seems to me, its greatest importance lies in the educational value of the scheme of its construction; the beauty of its setting; the magnificence of its palaces; the vastness and variety of its exhibits and the opportunity it offers for the interchange of ideas and the development and application of theories afforded by its hundreds of congresses representing every art and science, craft, trade, profession and fraternity entering into the complex fabric of modern civilization.

Not least among these, let us hope, is the Congress we are about to hold, for dentistry now occupies an enviable place among the liberal professions: recognized by the medical profession as a great and important factor in the healing art; holding the attention of the public to a greater degree than at any previous time; intimately entering into many schemes devoted to the public health and exercising a most potent influence on the future development of the race, it surely merits the respectful consideration of all those who live and labor for the good of humanity.

The widspread interest in dentistry as related to the public health is shown by the growth both in this country and abroad of the oral hygiene movement; the introduction of dental instruction in our schools; the organization of our army and navy dental corps; the appointment of competent dentists to care for the inmates of our prisons and public institutions and the establishment of free dental infirmaries for the poorer children of our public schools, most notable among these being the Forsyth Dental Infirmary for Children in Boston, founded by John Hamilton and Thomas Alexander Forsyth in memory of their brothers James Bennett and George Henry Forsyth, and endowed by them with about two million dollars, and one soon to be established in the City of Rochester, New York, through the generosity of Mr. George Eastman, and endowed by him with a fund of about one million dollars for the construction of its building and future maintenance.

These things speak in no uncertain terms of the results attained by the unselfish work of men and women everywhere laboring for the advancement of dentistry, and of the regard in which it is held by men of means and influence.

Our meeting here is but a means to the same end; the promotion of dental science and efficiency for the good of our fellow men.

Our program embraces contributions from eminent members of our profession in almost every country in the world where dentistry exists as an organized profession, but it is with keen regret that we note that many of our contributors from abroad will not be here to read their papers and present their clinics.

They have denied themselves the pleasure of attending our meeting, abandoned their practices and are to-day laboring in the hospitals or in the ranks of the contending armies of Europe.

All honor to them for having done all they could to make our Congress a success and for performing their duty to their country like true and valiant men.

There will be presented within these walls during the next few days a series of essays and clinics covering every subject included in the art

and science of modern dentistry, and it is with a sense of pride and satisfaction that we who live on this far Western shore of our great commonwealth realize that the Westward trend of travel, commerce and education has made this possible, that here in California, the land of fact and fancy, romance and accomplishment, the history of our profession is to be so enriched and so much is to be accomplished for the advancement of dental science.

And now, Ladies and Gentlemen, the Committee of Organization greets you most heartily, welcomes you most cordially and places in your hands the Panama-Pacific Dental Congress; it is yours to enjoy, promote and consummate; may its purposes be accomplished, its ideals realized, and may it above all else, advance in the most efficient manner the varied interests of our great profession.

Vice-Pres. Benbrook. We will now have addresses by our foreign delegates in alphabetical order. The first speaker will be Dr. E. Randolph Magnus, Sydney, Australia.

Dr. E. R. Magnus. Mr. Chairman, Ladies and Gentlemen: I feel it a great honor to be present here to-day among so many distinguished members of the dental profession from all parts of the world. Many of you I have known for over thirty years, and this re-union has been one of joy. I have also the honor to address you as President of the United Central Hospital of Sydney, and my Committee extends its good wishes to this Congress and wishes it every success.

Dr. Brophy made mention of what has been done by the Army and Navy Dental Corps. It may be interesting for you to know that although we are so far away from the rest of the world we have our dental school and dental corps. Sydney can boast of one of the best universities which is equal to anything in the world, and the dental school in connection with the university likewise has a very high standing, equal to the standing of any other dental school in the world.

In speaking of the Army Dental Corps, we have quite a number that are now at the front. Many of them are brother dentists. Had it not been for the terrible struggle that is now going on, many of them would probably be here to-day. I may mention what has been done in a little over three months' time, preparatory to the soldiers going away. We organized a scheme to look after these men, and the dentists of Sydney came forward and volunteered as honorary dental surgeons to the hospital. In three months' time, in addition to filling about fifteen thousand teeth, we extracted about twelve or fifteen thousand teeth, cleaning the mouths and finishing up the work, and we made I think eight hundred and four-

teen sets of teeth. The work that was done, had the Federal Government been paying for it, would have cost them something like nine thousand pounds. Notwithstanding we have a very fine dental school, many of our graduates from our university come to this country to get further instruction. Why? Because they recognize that the whole world is under obligations to America, which is the home of dentistry, and for that reason they come here to increase their knowledge. Those of us who finished our dental college courses many years ago find that we are not too old to learn. I think many of my colleagues will agree with me when I say that we have just begun to find out that we know so little. There is so much to be learned, and for that reason I am here to-day to secure all the knowledge that I can in reference to dentistry not only for myself and for my patients, but for the benefit of my brother dentists who are not able to come.

Probably, if I had not been here, I would have been with the Army Dental Corps and at the front at the present time, but perhaps my age debars me from that. I have done the next best thing. I have two sons, who have enlisted; one of them at the present time is at the Dardanelles, and the other one will soon perhaps be on his way, and immediately I return I expect a third one to go. That is the way the Australians have turned out. I am not an Australian by birth. My home is in New York; I am an American. I went out to Australia twenty-eight years ago, and I love Australia, and I love the Australians. I am very proud to be here to-day as one of their representatives. Mr. Chairman, I thank you for the honor of calling upon me. (Applause.)

Vice-Pres. Benbrook. We will now have the pleasure of listening to Dr. Alfred Burne, from Sydney, Australia and New Zealand.

Dr. Alfred Burne. Mr. President, Ladies and Gentlemen: After hearing with great pleasure many famous orators of America, it leaves very little for me to say. "It is a long, long way from Tipperary," a part of the land where I try to earn an honest living. (Laughter.) New South Wales is a country of which those who have had the opportunity of visiting it are very proud. Everybody is well treated, and that part of the Scripture which says, "I was a stranger and ye took me in" is not known in New South Wales. (Laughter.) We are proud to be represented and I have the distinguished honor of representing the Dental Board of New South Wales, Queensland, and New Zealand. Queensland is particularly happy to have a representative here. One of your distinguished members availed himself of a visit to our country. I refer to our friend Dr. C. N. Johnson. (Ap-

plause.) I want to say that in Australia, as in the United States of America, the mention of C. N. Johnson awakens a warmth in the heart which lives a very long time. As a dentist he came to Australia to our Congress a couple of years ago and presented a clinic and gave an impetus to professional life there which we shall never forget. I am pleased to see that some of the "boys" are present. Sometimes the youngsters do not care about attending these conventions, but when you see youngsters like Dr. Haskell turning out it is a pretty good sign. (Applause.)

Now I say this, which is a little out of the way, that Australia has done its work remarkably well. It is easy to talk, but when it comes to doing things, there are people who hold themselves in the background. New South Wales gave up half a million pounds. If you gentlemen of this Convention will multiply that by five, I think you will find that is quite a respectable number of dollars. I do not know that I need to say anything more, but we will go back a little, say twenty years ago, some of my friends on the platform will remember very well that I represented my country at the World's Columbian Exposition. Ten years ago I represented it in St. Louis with my wife. I did not have a wife the first time, but the second time I quite realized her importance. To-day for the third time I am with you; i represent my country, and to you, Ladies and Gentlemen, I give and bring fraternal greetings, and best wishes for the success of this Congress. (Applause.)

Vice-Pres. Benbrook. We will now have a few remarks from Dr. Thompson Boyd, of Melbourne, Australia.

Dr. Thompson Boyd. Mr. President, Ladies and Gentlemen: I come from Melbourne and the invitation to address you has been so unexpected that I have little or nothing to say. However, I wish to remark that sometimes the Melbourne people can hold up their end of the stick.

There is one thing we have done for our wounded soldiers. We gave five pounds for every one the English did. That is what we can do in Victoria. There is so little we can do in Australia, compared with the great big men you have here. We can only bring six pounders here. Particularly when you can show us such men as Dr. Platt we have nothing to say. We came here to listen and not to speak, and we hope to get the benefit and help of the members of this Congress. (Applause.)

Vice-Pres. Benbrook. We will now hear from Dr. Edward Caceres, Guatemala.

Dr. Edward Caceres. Mr. President, Ladies and Gentlemen: My beloved native land has most highly honored me by choosing me to come here with my distinguished

colleague, Dr. Robles, and by appointing me as Delegate to the Panama-Pacific Dental Congress, which opens to-day in this beautiful City of San Francisco, where at present is being celebrated most enthusiastically the greatest triumph of modern engineering, and with the Commissioner-General, Mr. Flemingo and Dr. Robles, we have brought to this great Exposition the felicitations of my Government. It is most gratifying to me to repeat these congratulations, and the sincere expression of good will for this great Republic which was founded by the immortal George Washington, who was first in war, first in peace and first in the hearts of his countrymen. (Applause.) But, at the same time, I manifest my best wishes with the profoundest emotion that emanates from the bottom of my heart, expressing gratitude for the distinction and honor you have conferred upon me by electing me Honorary President of this great Congress in which a great many of the most prominent members of the dental profession have assembled, and which Congress is one of the first evidences of the enormous benefits to be derived from the opening of the wonderful Panama Canal, an achievement that has been applauded by all the civilized nations of the world. (Applause.)

Vice-Pres. Benbrook. We will now hear from Dr. Florestan Aguilar, Madrid.

Dr. F. Aguilar. Mr. President, Ladies and Gentlemen: Your applause makes me blush to such an extent that I will not be able to talk. I am greatly pleased to bring greetings to you from my colleagues in Spain. We think of America like the gentlemen who spoke from Australia. We think of this country as the country of dentistry, as the birthplace of dentistry, and I assure you that it is a pleasure for anyone to leave Europe at the present time when the cannons are roaring, and arrive at a place where there is peace, and receive a hearty welcome and a friendly grasp of the hand. We want the deliberations of this Congress to go out so as to do some good for humanity.

I want to express my gratitude to the Congress, and particularly to the people and dentists of San Francisco, because the name of Spain is honored here. I have seen the colors at the Exposition and the flag of my country. The names of Balboa and Portola were pointed to with pride. Your forebears were right in giving names to the different cities of California. Why did they give these cities the names of San Jose, Los Angeles, San Joaquin and San Francisco? Because this is a beautiful country, and when I arrived in Los Angeles, which in Spanish, means "heaven," and heard of St. Francis, it occurred to me that all of the Saints

in arriving here thought they had arrived in heaven. (Laughter.) And that is the impression one gets.

I cannot neglect an opportunity to say to you that the next International Congress will be held within four years in Spain. If you come there you will receive a hearty welcome. It is the land of flowers and fruit. We have rapidly progressed in dental science there. In fifteen years we have had a revolution in our profession in the way of dental organization. We have fine dental schools. We have entirely abolished quacks. We have organized dental service in the army and navy, and we have inaugurated dental inspection in the public schools. All this has been accomplished by what we have seen in different countries, and by examples noted in attending such congresses as this.

Dr. Brophy said that if I could not have come to this Congress in any other way I would have come across the ocean in a canoe. I thought I was the only man from Europe attending this meeting, but I see another gentlemen who merits a distinguished and enthusiastic place in California; a man who is a worthy representative of American dentistry in Europe, because he has traveled through Europe doing good dental work. He is a man of the highest attainments in dental science. I refer to Dr. Younger, who comes from Europe. (Applause.)

Mr. President, in the name of my Spanish colleagues, and the Spanish Government I wish this Congress the greatest success. (Applause.)

Vice-Pres. Benbrook. If Dr. Younger is in the house we will be glad to hear a few words from him.

Dr. Younger. Mr. Chairman, Ladies and Gentlemen: I have been away from you for many years, and I have nothing to say of value. (Applause.) Dr. Younger received a prolonged oration, but was too overcome by emotion to speak.

Vice-Pres. Benbrook. I take great pleasure in introducing as the next speaker, Dr. M. Weiss, Government representative of Cuba.

Dr. M. Wiess. Mr. Chairman, Ladies and Gentlemen: It is a great honor for me to be here at this meeting of the Panama-Pacific Congress to represent my country and my Government. I wish to express to you my gratitude for the confidence you have recently shown me, and the courtesies extended to me. I bring to you a personal salute of respect and love from the President of Cuba and the people of Cuba. In coming here as the representative of Cuba, I wish to learn more and more of the progress that has been made, and is being made in dentistry. I have come to work with you, and I am sure

that I will carry back to my country new knowledge obtained here among you, and this knowledge will be extremely useful to my fellow dentists in Cuba and to my people. Again I thank you and wish to express once more my deepest gratitude for San Francisco's hospitality. (Applause.)

Vice-Pres. Benbrook. The next gentleman whom it is my pleasure to introduce to you is Dr. R. McClinton, of Tasmania.

Dr. R. McClinton. Mr. Chairman, Ladies and Gentlemen: I have the pleasure of representing the smallest State here—Tasmania. It is a double pleasure in this respect, for I am bringing our fellow co-operators in dentistry closer together. It is also a great pleasure to me to represent my fellow dentists here, because it gives me an excuse to come back and visit my native State again and my friends.

In Tasmania we are the first naturally to look at things from the opposite viewpoint. We look at them through the sun which casts a shadow to the South. Compared with you we look for that great luminary from the opposite direction. We look to the North to see dentistry, and our eyes are turned upon this great Congress for the good which will accrue, and it will be a great pleasure to me to carry back to my colleagues a report of this Congress.

I am sorry that I cannot speak better than I have, but I have not the confidence of a patient who came to me a little while ago. She said, "Doctor, I have a plate, and it is a misfit. I cannot eat with it, I cannot talk with it, I cannot sing with it or do anything. I will give you anything you want to charge if you will make a plate that will fit me." I put her down as a crank. She said, "I know I can be fitted. I tried a plate of a lady friend of mine from Sydney, and it fitted me beautifully." (Laughter.)

Vice-Pres. Benbrook. We will now listen to some remarks by Dr. Whitney, of Honolulu.

Dr. J. M. Whitney. Mr. Chairman, Ladies and Gentlemen: A short time ago I received a letter from New York with a five cent stamp on it, the writer of the letter thinking I was in a foreign country, but you all know that Honolulu is a part of this country, and I am glad to be here to rejoice with you, and to enjoy all that this great Congress will bring. I have looked forward to it for many years, and I have thought it would mark up-to-date all of the knowledge that we possess at this time in dentistry. I expect to hear many things that as one of the early dentists I will hardly understand or appreciate, but I shall try to carry back to Honolulu many of the modern ideas which will be of benefit and a blessing to others. I thank you for seeing your faces and for the reception you have given me. (Applause.)

Vice-Pres. Benbrook. I take pleasure in introducing as the next speaker Dr. J. Schneider, of San Salvador.

Dr. J. Schneider. Mr. Chairman, Distinguished Colleagues, Ladies and Gentlemen: Although literally a native son of the Golden West, I am here to represent the little Republic of San Salvador, which unfortunately so many people know so little about. I am sorry the rest of the committee representing that country have not been able to come here, so that they could enjoy the world wide hospitality which is so characteristic of San Francisco and California, and witness the spirit of fraternity manifested by all of these delegates, by all of the men of the dental profession, and carry back with them new ideas. We have seen more than once the cordial spirit which the people of the United States have manifested toward us, and we hope that at some time we shall be able to create a spirit that will knit the Latin-American people together, and if possible, bring them closer to us, so that we will forge on together, and be, you might say, as one on this continent. I wish that the country South of us could have seen this large delegation, and if we do not reap anything from this Congress more than that, it will be a great thing. I am sure everyone will go home from this Congress a better man professionally and otherwise. (Applause.)

Dr. Belcher, of Rochester, New York, was called to the platform and asked to say a few words.

Dr. Belcher. Mr. Chairman, Ladies and Gentlemen: I do not know just what to say to this California audience, but I respect Colombia. They have elected me to honorary membership in the Mouth Hygiene Association, and from the correspondence I have had with them, that Association must be in a flourishing condition. I am to give them a report of all of the work of this Congress.

I wish you could read some of the letters I have received from South America telling how interested dentists are in this mouth hygiene work. In the begining we tried to give them details of the work as we have progressed to-day, but we had to begin at the A, B, C's. It is like having a boy in the laboratory who makes all the mistakes you make, and so the people of South America are begining at A, B, C of the work, but I think they will go ahead and do wonderful work in mouth hygiene in South America. I thank you. (Applause.)

After the reading of announcements and telegrams by Dr. Arthur L. Flood, Secretary of the Congress, President Platt declared the opening session of the Congress adjourned.

Papers Presented in Section I

Anatomy—Physiology—Histology

A Brief Synopsis of a Paper Entitled Mottled Teeth; an Endemic Developmental Imperfection of the Enamel of the Teeth Heretofore Unknown in the Literature of Dentistry.

By Frederick S. McKay, D.D.S., Colorado Springs, Colorado, in collaboration with G. V. Black, M.D., D.D.S., Sc.D., L.L.D.

It is my privilege to present herewith a synopsis of a paper dealing with an investigation into the prevalence and distribution of a lesion of the enamel, which, so far as I know, has heretofore been mentioned in dental literature only in the most meagre way, and which has never before, to my knowledge, been described either accurately or comprehensively.

The time limit placed upon essays read before this Congress precludes anything more than the briefest consideration of this lesion, but a complete description of its pathology and histology in relation with the commonly known enamel lesions, is soon to be published by Dr. G. V. Black, and as a companion paper a complete essay dealing with its investigation will be published by the writer.

Mottled Enamel

The term "Mottled Enamel," was applied to this lesion by the writer somewhat empirically, but has become probably the accepted designation, having been suggested by the appearance of the teeth.

The remarkable thing about the lesion is that it seems to be absolutely limited in its distribution in any large way, to certain well defined geographical areas, in which it occurs in the teeth of only those individuals who were either actually born and lived continuously in any of these areas during the years of enamel formation: or in those who, although being born elsewhere, came into such districts for continuous residence during the years of enamel formation. These circumstances indicate that we are dealing with a developmental dystrophy, and the term "endemic" is applied because the lesion is peculiar to a district or particular locality or class of persons. (Natives and those coming in early childhood.)

An endemic disease is one constantly present to a greater or less degree in any community or locality, and the investigation of this condition has left no doubt that a high percentage of those persons who conform to the conditions just set forth will exhibit mottled enamel upon the

permanent teeth when they erupt. This seems to be a law pretty definitely determined, as will later be shown, as applied to all such districts as can properly be termed "afflicted," "susceptible," or "endemic."

Description of Mottled Enamel and Brown Stain

Normal enamel is a dense, homogeneous structure, in which the enamel rods are closely bound to each other, and in turn into columns, by a structureless calcified material, variously termed the "cementing" or "interprismatic substance."

Mottled enamel is charaterized by minute flecks, or larger white areas scattered irregularly, or streaked over the surface of the teeth, or it may be a condition where the entire tooth surface is of a dead paper white, like the color of a china dish. In many cases the surface of the tooth is dotted with irregular, shallow pits, which may be darkly discolored because of the lodgment therein of debris. Such are spoken of as the "pitted" variety.

Any, or all, of the teeth may be mottled, or certain groups only, according to circumstances which are discussed in the complete essay and in Dr. Black's paper: or the area of some teeth, either above or below a certain point, may be mottled, and the rest of the enamel of such teeth may be practically normal.

In some slightly marked cases the white areas are found only on the points of the cusps, the rest of the enamel of these teeth appearing normal. The teeth present this appearance upon eruption, and the pits are present—when present at all, at this time. Perhaps the most frequent location for the pits is near the points of the cusps on the cuspid and bicuspid teeth. Upper and lower teeth seem equally liable to mottling, and upon all surfaces, although as a rule the labial and buccal surfaces have the most pronounced markings. If there is any difference, the upper teeth are most affected.

Mottled enamel, in my experience, has never been found upon the temporary teeth. In examining children in afflicted districts at ages when the permanent incisors and first molars have erupted, the temporary molars being still in place, the contrast in the enamel on these two classes of teeth is most pronounced. The white mottled enamel on the permanent teeth exhibits a marked contrast with the normal enamel on the temporary teeth, which has the customary almost bluish tinge.

However, there is an associated phase of this lesion—the "brown stain," and in this feature we come upon the most serious and distressing phase of the problem.

Black's study of the histology of this condition, as yet unpublished, has demonstrated that the initial or fundamental lesion is the failure of

the cementing substance between the enamel rods, and it is the deposit of some sort of brown pigmented substance, termed by him "Brownin," in these otherwise empty spaces that produces the "brown stain." In only approximately forty per cent. of individuals who have mottled enamel is the "brown stain" present, and this occurs in all grades of intensity, from the faintest spots or tinge up to almost an ebony black. It is a most distressing and remarkable fact also, that the discoloration is almost invariably located in the most conspicuous place—the labial surfaces of the upper incisors and cuspids. Rarely is it found upon the lower front teeth, and still more rarely upon the lingual surfaces of either upper or lower teeth.

In its usual manifestation the stain is located upon the incisal half of the surface, and as a rule the central incisors will have the most, the lateral incisors somewhat less, and the cuspids still less and perhaps none at all. On the central incisors the stain may be about the middle of the labial surface; somewhat lower down on the lateral incisors, and just on the points of the cuspids.

It is extremely erratic in its distribution, although in general, following the plans just outlined. I can recall distinctly only one case in which the molars were thus marked, this occurring in one of the Arizona districts; but cases have been seen in which the entire denture, including the third molars, was of a dirty, smoky appearance. The bicuspids are not often discolored in any typical way.

The same rule as applied to the freedom of the temporary teeth from mottled enamel holds good regarding their immunity from the brown stain. Never, to my knowledge, has this been observed in the temporary teeth.

Localization

The investigation thus far has been chiefly concerned in locating and outlining the afflicted districts and determining what proportion of the natives of such districts were affected. This has necessitated the examination of more than 8,000 school children to date, and several districts of various sizes have been located in certain parts of the Rocky Mountain Region in which the percentage of natives afflicted has varied from 15 up to 50, 88, 93, 95, and even 100.

A very large area of pronounced affliction has been located in one of the Southwestern States, and running into Old Mexico: a small localized district in another of the Southwestern States; two communities not more than ten miles apart in one of the South Atlantic Seaboard States, and a small district near Naples, Italy. These districts have all been examined in detail, except the latter and are described in detail in the complete essay.

A comprehensive idea of the behavior of this dystrophy toward those not native, but who became residents of an afflicted district during the different childhood years, is gained by analysis of the figures given in the following table:

BEHAVIOR OF MOTTLED ENAMEL TOWARD THOSE COMING INTO AN AFFLICTED DISTRICT DURING THE VARIOUS CHILDHOOD YEARS

	Incisors and First Molars						Bicuspids and Second Molars					Third Molars			
Years	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Mottled	102	76	41	56	39	28	20	9	9	4	8	4	13	1	0
Normal	25	34	39	57	80	87	123	120	129	105	88	87	56	49	29

It is only by a close analysis of this table that one can realize the peculiarities of this condition as it affects children born in other regions, or, let us say, in immune territory, but who come into afflicted territory at various ages.

Explanation of Table

Some explanation of this chart seems necessary. The permanent teeth are divided by Black into three groups as to their developmental periods. In the first group are the incisors, cuspids and first molars, between the first and seventh years. The bicuspids and second molars, are forming between the fifth and eleventh years, and the third molars from the tenth to sixteenth year. These figures are approximate. By this time all enamel has been formed.

Using the figures for a certain city a most peculiar progression is noted in children born elsewhere. One hundred and two of such, coming into an afflicted district at the age of one year, showed mottling of the incisors and first molars, and twenty-five had normal enamel. Of those coming at the age of two years, seventy-six were mottled and thirty-four were normal. And so on; the older children are when they come into an afflicted district the less the likelihood of the enamel being injured.

It will be noted that so far as the incisors are concerned, those coming at the age of one or two show a large proportion of susceptibility. For the ages of three, four, five, and six, the proportion of normality of enamel of these teeth is increasing with a corresponding decrease of

mottling. The interpretation of this is that the more advanced the process of enamel formation at the time residence is begun in an endemic district, the less chance there is of damage to the enamel.

Looking again at the same row of figures we see that the second group of teeth, the bicuspids and second molars are in greatest danger of injury in those coming at the ages of six and seven, and the danger dimishes from that time on, as is shown by the increase of normality in the line of figures next below.

Coming now to the third molars we note that these teeth are in greatest danger at about the age of thirteen, and it is understood, as previously stated, that at about this age the enamel of all of the other teeth has been completed, and is therefore safe as regards this lesion, but that the third molars will be mottled when erupted. The absolute uniformity with which this age progression was found to operate in all examinations conducted in widely separated endemic areas, leads us to formulate what can be called a rule, which operates with almost mathematical exactness.

The rule is as follows: In highly susceptible districts about ninety per cent. of native children will exhibit the lesion, and if residence has been continuous, all teeth are likely to be affected. Those coming in early infancy show practically as much damage as though actually native born. The liability of damage to the incisors will progressively diminish after the second year, up to the sixth, allowing for the difference in rapidity of enamel growth in different individuals. After six years of age the enamel of the incisors is practically safe. Those coming between the ages of six and eight will, as a rule, escape damage to the incisors, but the bicuspids and second molars will be mottled. Then, after this time, the third molars will be the only teeth affected. These ages are understood to be approximate only.

Many cases have been seen in which the rest of the denture, having been built in non-endemic territory, was covered with normal enamel, but having established residence in an endemic locality after that, and during the development of the enamel on the third molars, these teeth were mottled.

It is a remarkable fact that this disturbing influence almost without exception at once attacks all forming enamel just as soon as an individual comes into one of these districts, and always produces the same lesion.

White Enamel

It is hard to convey by illustrations, an idea of the appearance of that phase of the condition which is spoken of as "white enamel," or enamel in which the cementing substance is uniformly lacking (to the unaided eye) over the outer surface, giving the dead, paper-white

appearance. This condition, which is quite common, is disagreeable in appearance, and renders the individual conspicuous, but not nearly to the same extent as when the brown discoloration is present.

Discription of Illustrations

The illustrations which follow have been selected with the view to giving as comprehensive an idea as possible of the widely differing phases that this lesion assumes, and are in the most part photographs in colors.

Figure 1 illustrates a case in which the surface is irregularly speckled or mottled.

In this case very little of the brown stain is present, but the enamel is very much mottled and somewhat pitted as shown on the points of the cuspids. The entire denture is of this character. This person is a native of L—which community is described in the complete paper.

Figure 2 illustrates a pronounced case of the pitted variety, in which the teeth are of a dirty or smoky color, and the pits are very much darkened.

In severe cases these pits become the seats of caries, hence, are a distinct menace, this having occurred in several in this illustration.

This case is very badly disfigured. The darkening of the pits somewhat overshadows the brown stain, which is present to some extent, and the enamel is very rough.

We see the opaque white appearance of the lower incisors, upon some of which are the brown marks, which is quite unusual upon these surfaces. The enamel of the entire denture is of this character. He is a native of L—.

Figure 3 shows just the slightest tinge of brown upon the central incisors, the left one having the most. The enamel of all the teeth is white, but the lower incisors are not stained. The pitted appearance of the right first bicuspid is just shown in the photograph. This child is a native of L—.

In Figure 4 we see the opaque whiteness of the enamel as before described, and upon the prominent mesio-labial surface angles of the central incisors are brown spots. The lateral incisors have just a trace at the mesio-labial corners. Many cases show just such a symmetrical location of the brown spots occurring at the same corresponding places on teeth of the same class. The entire denture is of this opaque, white appearance, and the bicuspids and molars are pitted somewhat. This child is a native of L—.

The location of the brown stain in Figure 5 is at the extreme labio-incisal edge of the central incisors, and it is most peculiar that it stops

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 17

Fig. 19

Fig. 20

just there at the incisal edge, and does not proceed up on the lingual surface of these teeth.

The writer has never seen a case where the stain continued over the incisal edge from the labial surface onto the lingual.

The lateral incisors and the lowers are not stained, but the mottled

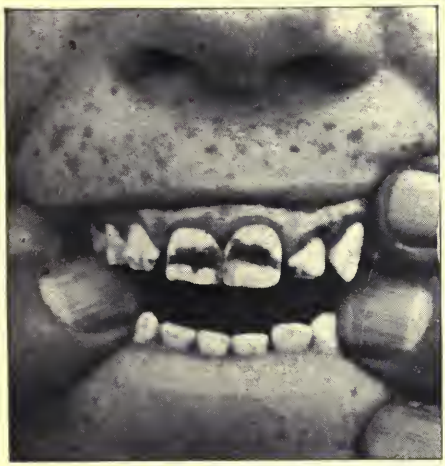

Fig. 6.

Fig. 7.

Fig. 8.

character of the enamel is well shown. The entire denture is mottled, and the bicuspids and molars are pitted. This child is a native of L—.

Figures 6, 7, and 8 are typical cases made from ordinary black and white negatives. They all show marked symmetry in the distribution of the stain. The children are all natives of L—.

In Figure 9 we have a more pronounced stain, which is located somewhat symmetrically upon the central incisors. No other teeth are thus

marked, but the opaque whiteness of the enamel is noticeable. The entire denture is of this character. The child is a native of L—.

Figure 10 shows a darker discoloration than any previous case, being almost black upon the central incisors and symmetrically arranged. The labio-incisal edges of the lateral incisors are also stained. This case is one of those rare ones that show the stain upon the lower incisors. The opaque whiteness of the upper teeth is well shown, and the mottled ap-

Fig. 16.

pearance of the lowers. A pit is noticed at the point of the left cuspid. The boy is a native of L—.

Figure 11 is badly pitted and stained, although the lower teeth show only the mottling. The boy is a native of L—.

Figure 12 shows a very pronounced case in which the stain occupied almost the whole labial face of the upper central incisors and a part of the lateral incisors. Here also we see a slight stain on some of the lower teeth. It is curious that when the stain does occur on the lower teeth, it is never so pronounced as upon the upper. This girl is a native of L—.

Figure 13 shows a symmetrical location of the stain on the upper central incisors almost in the form of a band across from mesial to distal. The laterals are also stained, but the lower teeth have escaped. These latter show the mottled appearance, with pitting of the cuspids

Figure 14 is a side view of the preceding case, and illustrates the pitted appearance of the teeth. The boy is a native of L—.

Figure 15 is one of the most pronounced cases of mottling and staining of the entire denture that I have ever observed.

The subject is a male, aged twenty-one. He was born on a ranch just outside the town upon which he has lived continuously until the past year. As is rarely seen, the lingual surfaces of the upper incisors were also stained: the lower incisors were also stained, and even the first molars, which latter must be regarded as a most unusual manifestation

of this lesion. The enamel on all these teeth was very imperfect, being badly pitted, particularly on the molars and bicuspids.

Figure 16 is another typical case, indigenous to the same city as the previous case, which is, unfortunately, not in colors. His history in detail is not known.

Figure 17 is among the most pronounced ever observed by myself. The illustration gives hardly more than a fair idea of the condition. The

Fig. 18.

entire denture is of the mottled and pitted character. The subject is an Indian boy, observed on a government reservation. One hundred and fifty children of this same tribe were examined at this same school on the same day, and they all exhibited this same condition in greater or lesser degree.

Dr. Black makes mention in his paper of certain sporadic cases that have come under his observation from districts that cannot be considered in the sense of our definition as "susceptible" or "afflicted" districts, and such a one is illustrated in Figure 18.

While my observation of such has necessarily been limited, yet it is my experience that while the appearance and distribution of the brown discoloration is typical, yet the mottling of the enamel is not nearly as pronounced nor so general as in those cases which originate in the various afflicted districts. In other words, the enamel in general seems to be of more normal or homogeneous structure, and this feature I think is apparent in the picture, although some mottling is visible.

This case originated in what is so far as I know, non-endemic territory, and the photograph was furnished by Dr. Max Giesecke of Denver.

Figure 19 serves admirably to illustrate the symmetrical distribution of the stain upon the upper central and lateral incisors. The absence of stain upon the lowers is to be noticed. The case is typical in many ways.

Figure 20 is extremely interesting inasmuch as the subject is a colored person and the case very typical.

I will call attention to the general mottled condition of upper and

lower teeth, the pitted cusp of the lower first bicuspid on the right side, which is present upon other teeth, but not shown in the illustration—chiefly to the irregular distribution of the stain upon the upper central incisors, and the symmetrical staining of the upper lateral incisors. The lowers are not stained.

This case effectually disposes of the question of nationality, in its bearing upon this lesion, and emphasizes that its acquisition disregards nationality, social status, condition of physical health, in fact all other circumstances except the one essential, namely residence in an endemic district during enamel formation.

Conclusion

The etiology of this condition has not yet been determined, but the investigation has been prosecuted upon the assumption that water is the causative factor. Much evidence has been collected which shows that the water used during the years of enamel formation bears a suspicious relation to the presence of this lesion, but at present no definite conclusion has been reached.

Practical Application of a Knowledge of the Histology of the Peridental Membrane.

By Dr. F. C. Friesell, Pittsburgh, Pa.

It is rather difficult and unsatisfactory to consider any of the investing tissues of the teeth without referring to its correlation with others, and in order that we may all understand, permit me to name these tissues and give a short description of them.

The investing tissues of the teeth are the gingivæ, the peridental membrane, the cementum, and the alveolar process. The gums cover the alveolar processes and the hard palate, and the gingivæ cover the gingival portion of both the roots and crowns of the teeth, pass between the adjoining teeth connecting the soft tissues of buccal and labial parts with the lingual parts and surround each tooth.

Gingivæ. The gingivæ are described as consisting of the body, the free gingivæ, and the septal gingivæ. In referring to the free gingivæ we attach the name of the part of the crown against which they are imposed, namely: the buccal gingivæ, the labial gingivæ, the lingual gingivæ; and the interproximal portion as the septal gingivæ. The term sub-gingival space is given to the space between the free gingivæ and the enamel which it covers. The body is attached to the gums by continuity of the tissues; to the bony alveolar process by the periosteum, and by fibres of the peridental membrane to the gingival portion of the roots of the teeth on a level from alveolar crest to gingival line.

Cementum. The cementum is the bonelike structure covering the root except at the apical end. It has its origin from the peridental membrane and encases the fibres of this membrane. It is deposited in layers or lamellæ, and these may number from two to twenty.

Alveolar Process. The alveolar process is the projection of bone which grows up around the roots of the teeth and forms the sockets in which the roots are held by the peridental membrane.

Peridental Membrane.

The peridental membrane comprises that tissue which lies between the root of the tooth and the bony walls of its alveolus. Various names have been given to this tissue, namely: alveolo-dental membrane, dental periosteum, alveolar dental periosteum, pericementum, and so forth. It belongs distinctly to the class of fibrous membranes, and its functions are vital, physical and sensory. Its vital function is evidenced in its being the place of development of the osteoblasts, which build a portion of the alveolar walls, and of the cementoblasts, which build the cementum. These cells are supposed to be received in the meshes of the membrane from the blood stream as leucocytes or amœboid cells, and here undergo development or differentiation, specializing them for building of bone and cementum. During the development they are distributed to their respective places, the surface of the bone and the surface of the cementum.

The physical function of the peridental membrane is the holding of the tooth in its position, a function performed by the fibrous elements. These fibres, known as the principal fibres, form the bulk of the tissue of this membrane and their ends are fixed in the cement of the tooth's root on one side and in the bone which forms the wall of the alveolus on the other, and are stretched across the intervening space in various directions and in such a manner as to swing the tooth in its socket.

The sensory function of this membrane is supplied by an abundance of nerves which enter it from every direction through the walls of the alveolus, at the apical space, and by way of the gingival border below the rim of the alveolus.

Careful use of the microscope in examining well prepared sections of a peridental membrane will bring into view a number of structural elements—osteoblasts, cementoblasts, fibroblasts, osteoclasts, blood vessels, nerves, epithelial cord of cells, and cells and fibres found between the principal fibres of the membrane, but not functioning like them. The membrane surrounds the tooth and fills its alveolus, and more than this, for it invests the tooth farther toward the enamel of the crown than the lowest border of the alveolar wall.

For descriptive purposes we refer to three portions of the peridental membrane: the apical, that surrounding the immediate apex of the root or occupying the apical space; the body, which fills the alveolus from the apical space to the lower border or rim of the alveolar wall; and the cervical or gingival portion, that immediately surrounding the neck of the tooth below the rim of the alveolar wall.

As previously stated, the peridental membrane is composed of fibrous tissue of the white, inelastic variety. The greater bulk of the membrane

is composed of fibres that have their attachment in the cementum on one side and are carried to the alveolar wall or into some other tissue, in this way serving to maintain the tooth in its position. Because of this function, this group of fibres becomes first in importance in our study, and the other elements are arranged in a manner not to interfere with these *principal fibres,* as they are termed.

Fibres of the Peridental Membrane.

The principal fibres are divided into three main groups: the horizontal, the oblique, and the apical group. The horizontal group consists of those fibres which pass out at right angles to the long axis of the tooth and are attached to the bone of the alveolar process, a little below the crest. They tend to prevent the lateral movement of the apex. The oblique are those which pass from the cementum in an oblique direction occlusally and are attached to the base of the alveolar process. These constitute the body of the peridental membrane, or the fibres which cover the main body of the root portion of the tooth. The apical group are those which are attached about the apical portion of the root and extend in fan-shaped bundles to the surrounding alveolar processes; in conjunction with fibres from the oblique group, they hold the apex centrally in its socket against any lateral pressure that may be brought to bear upon it. The function of these three groups of fibres, assisted by the groups in the gingivæ, maintain the tooth in its socket and support it against the stress of mastication.

Blood Supply of Peridental Membrane.

The blood supply of the peridental membrane is abundant; vessels entering at the apical space run through the membrane to the alveolar crest, and others come through the alveolar bone and over the crest, dividing frequently into branches and smaller capillary vessels.

Nerve Supply of Peridental Membrane.

The nerve supply follows closely that of the blood vessels, and usually in close association, passing longitudinally along the membrane. A tooth may have lost the tissue from the apical space, or the whole of the gingivæ may have been cut away, and yet the blood and nerve supply may be maintained. The collateral circulation through the bones and the nerve supply by the same way will amply support its vitality and the sense of touch for the tooth not be impaired so long as there remains any attachment of the peridental membrane at any portion of the root.

Osteoblasts.

The osteoblasts of the peridental membrane lie upon the bone of the inner surface of the alveolar

process, so close together as to form a continuous line except at points where the principal fibres pass between them. Fibres of the membrane detached from the bone, either by absorption or otherwise, may be reattached by the osteoblasts building new bone, the fibre ends calcifying with this bone.

Cementoblasts.

The cementoblasts lie upon the cementum of the tooth like the osteoblasts on the surface of bone, and are the agents in the building of cementum by depositing lime salts; and certain of these cells are left in the cementum as cement corpuscles. Cementum has no blood circulation and cannot receive through the dentine any assistance in rebuilding absorbed portions. Such replacements must be through the peridental membrane, and when this membrane has been removed with the absorption of cementum, if there be no suppurating conditions present—if the substance of the cementum is not saturated with pus and the cementoblasts are still present—then and then only can there be new cementum deposited.

Epithelium.

Lying close to the cementum, but not in contact, are found many epithelial cells among the principal fibres, generally in the form of strings—strings of single cells touching each other. They are found everywhere around the root, but the strings are disposed to run lengthwise of the root. The recognition of these cells as epithelial structures in peridental membrane is reported by several recent writers who have made close and careful microscopic study of them; and all agree that these cells multiply in the peridental membrane, break up, and form sheets of cells which surround certain areas of infection and cut them off by encysting them.

Such a tissue as the peridental membrane, having so varied a collection of elements and performing a function that is foremost in the full activity of the dental organs, ought to be more thoroughly studied and given more consideration in the daily routine of the dentist's practice. Without proper appreciation of the possibilities for trouble that lie in the injury of any part of this membrane or of contiguous tissue, the best operations of mechanical restoration of the tooth structure or outlines will be worthless; for if the tooth loses the support of its peridental membrane it will change its position in relation to its neighbor in contact or to its opponent in the opposite jaw.

Factors Causing Disease of Peridental Membrane.

The peridental membrane is not so often the initial seat of pathological conditions resulting in the crippling or loss of teeth, but, as has been stated, its intimate relations in contiguity with other soft tissues subjected to direct injury makes it secondarily

freely susceptible to injury and infection, and calls for careful and painstaking observation on the part of the dentist. Failure to observe and overcome by restorations the shifting of the contact point by reason of natural wear from use; lack of attention to replacing a tooth lost by extraction; non-removal of calculus from subgingival spaces; unreasonable stress in orthodontia treatments; improper form to fillings; too generous a length to gold crowns or bands; too vigorous means in scaling the teeth; improper application of ligatures in using rubber dam—any or all of these conditions may result disastrously to the patient through injury to the peridental membrane, ranging all the way from a decided discomfort in gingivitis to death from absorption of bacterial poisons.

The trouble may be so tardy in its appearance, so insidious in its progress, and the symptoms so obscure that only the operator skilled in his work and possessing an adequate knowledge of the minute structures and their pathological possibilities can be classed as a man who is practicing dentistry as it is possible to be done and as he should be able to do it.

The time has passed when the laity was ignorant of the possibilities of dentistry, for special articles in magazines and secular and religious papers are read by multitudes, and the dentist is asked some very pointed questions by patients who are not suspected of reading about dental doings. At intervals some new treatment is brought to the attention of the profession which in its administration suggests to the "live-wire" the necessity for investigation of the tissue involved, and there has been a deplorable scarcity of literature on the subject of the peridental membrane until 1887, when Doctor G. V. Black produced a book on the *"Histological Characters of the Periosteum and the Peridental Membrane,"* after having printed the contents in a serial form in the *Dental Review*. Of course, this was not the only effort to embrace the subject between the covers of a book, but previous contributions had been of such a limited character as to form only an irritant or incentive to more systematic study of the subject by original examination of prepared tissues. Improvements in technique for the preparation of specimens also gave promise of more possibilities and the work mentioned was wholly the result of the personal labor of the author. Within the last three months another volume as come from the pen of Dr. Black, and it is the most complete one in its bearing on the special dental pathology of the peridental membrane and the pulp. Any one desirous of fitting himself more fully for the practice of the dental profession will gain much valuable information from a study of the book referred to.

There has been a conscious effort in the arrangement of this paper to avoid specific detail of the many diseased conditions which the peri-

dental membrane may present, trusting that the discussors will take care of such phases; therefore, only general references to a few of the leading points have been made. My object has been to refresh your memory regarding the histological character of the peridental membrane, and if possible to stimulate a desire for a more intimate knowledge and application of these facts.

The recent popular shifting by the profession of medicine to the profession of dentistry of the responsibility for obscure diseases, together with the advances made in almost every department of science, make it necessary for the dental profession to demand, procure and encourage the best prepared young men to investigate the diseases of dental origin and systematically record and publish the result, supplementing the great work accomplished by a comparatively small number of men in the effort to keep the profession of dentistry abreast with the times.

Changes Produced in the Circulation by Gas-Oxygen During Dental Analgesia and Anesthesia.

By Theodore D. Casto, D.D.S.
(Instructor in Analgesia and Anesthesia at the Philadelphia Post-Graduate School of Dentistry, Philadelphia, Pa.)

A study of the literature during the past decade reveals but little original work upon the changes taking place in the blood stream during or at varying intervals after the administration of anesthetics to the living subjects.

Boston and Anders (1) in their experiments with the human subject under anesthesia found that there was an increase in erythrocytes after the first twenty minutes of anesthesia. Microcytes were very numerous, but no poikilocytes or macrocytes were noted. In a second experiment, made upon the same subject at a later date, megoblasts were found to be present and also a few microcytes. There was a reduction in the percentage of hæmoglobin, and this reduction was maintained for twenty-four hours after the ether had been given.

Buxton (2) also found a reduction in percentage of hæmoglobin after etherization and also a reduction in the time of coagulation of the blood.

Gwathmey (3), on the contrary, called attention to the fact that the time required for coagulation of the blood was increased.

Casto, working in conjunction with Bassett and Gildersleeve (4), proved that in the blood of rabbits there was a marked reduction in hæmoglobin after anesthesia with nitrous oxide and oxygen. They also demonstrated a decided reduction in the time required by the blood for coagulation.

(1) Drs. J. M. Anders and L. N. Boston, *Therapeutic Gazette,* November, 1904.
(2) Dr. Dudley Wildmer Buxton, *Transactions of the Odontological Society,* Vol. 18-19.
(3) Dr. James Taylor Gwathmey, *Anesthesia,* D. Appleton & Co., 1914.
(4) Dr. T. D. Casto, *Dental Cosmos,* August, 1915.

The blood studies presented in this paper were made upon the human subjects and confirmatory studies were also made upon tame and wild rats.

Selection of human subjects was made from physicians and nurses, as it was essential that there should be neither fear nor anxiety on the part of the patients and that both their co-operation and interest in the furthering of the studies be obtained. All of the cases chosen were entirely free from alveolar abscesses and were in a normal physical condition.

During the time that the subjects remained under the anesthetic, teeth were extracted, pulps removed or cavities prepared for fillings as indicated by the condition of each individual. Hypodermic injections of analgesic drugs were never resorted to before the commencement of anesthesia. The blood required for study in each case was taken from the little finger of the left hand, a firm small blood lancet being used throughout the work.

The blood counts were taken immediately before anesthetization with nitrous oxide and oxygen, immediately upon return to consciousness, and at intervals of time varying from ten minutes to three hours after recovery of consciousness.

A study of Tables 1 to 6* will show that during anesthesia both the number of the cellular constituents of the blood and the percentage of hæmoglobin underwent a change from the normal in each particular individual. These changes were not always of equal importance or in the same direction, but the tendency to increase or decrease followed certain definite lines.

The general tendency of the erythrocytes was to decrease during anesthesia, an average loss of 16% being obtained in the eight cases studied. The tendency of the leucocytes was to increase during anesthesia, an average gain of 16% being obtained in the eight cases studied.

Changes were also found to be taking place in the different varieties of leucocytes. There was found to be an average increase in small lymphocytes of 12%, in large lymphocytes of 4%, and in transitional forms of 16%. An average decrease of 7% was found in the polynuclear neutrophiles. Poikilocytes, macrocytes, microcytes and nucleated cells were not observed at any time during the examination.

There was a more or less pronounced reduction of hæmoglobin during anesthesia throughout the entire series of cases, and the time required by the blood for coagulation was also decreased.

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*The haemotological examinations were made in the Philadelphia Clinical Laboratory by Dr. E. Q. St. John and Associates.

Case 6. Miss W. was of special interest, owing to the fact that nitrous oxide gave out and recourse was had to ethyl chloride during the last seven minutes of anesthesia. An increase of 36% in erythrocytes was found immediately upon return to consciousness. Ten days later, nitrous oxide and oxygen was again administered and continued throughout the whole period of anesthesia, a decrease of 28% in the erythrocytes being found upon return to consciousness.

Case 7. Miss P., 20 years old, weight 120 pounds. The patient was kept under deep anesthesia during the preparation of four cavities for filling. This case showed but very slight reduction in the number of red cells, a decrease of seven-tenths of one per cent. being found immediately after return to consciousness and to nine-tenths of one per cent. an hour later. These slight amounts of decrease stand well within the limit of error, so that in this case the erythrocytes may really be considered as remaining practically the same throughout anesthesia. The leucocytes, however, show an increase of 50% immediately after return to consciousness with a further increase to 69% one hour later.

Case 8. Miss E., age 23, weight 110 pounds. Nitrous oxide and oxygen was given for thirty-five minutes to induce narcosis for the extraction of teeth, and cocain was used locally during removal of pulps. The erythrocytes did not show the reduction in numbers found in the majority of the cases studied; on the contrary, there was an increase of 444,000 upon return to consciousness. There was a gradual loss in the number of red cells during the two hours immediately following the removal of the anesthetic, and at the expiration of that time the count was practically the same as before anesthesia was induced. The leucocytes showed a considerable increase in numbers during and after the administration of the gas, and there were also changes in the percentage of the different varieties of white cells present (see Tables 1 to 6). This case was rather difficult to manage throughout the operation; she never became subjective, but was continually resisting every movement of the operator. The patient showed great exhaustion for at least two hours after return to consciousness, although she stated she had no recollection of pain during treatment. These facts, combined with the use of cocain in the above case, may account for some of the unexpected changes found in the blood cells.

Studies Upon the Blood of Tame and Wild Rats.

In making counts of the blood of both tame and wild rats, the end of the tail was chosen for puncture before the administration of gas, and wherever practical was also used at the close of anesthesia. When, however, it was impossible to obtain the blood in this manner, it was taken from the coronary arteries or the heart itself.

A discussion of the chief points of interest in each rat experimented upon will now be taken up; a detailed account of all the changes occurring in the blood during anesthesia will be found in Tables 7 to 9.

Rat 1. Tame, weight 60 grams. The animal was kept under a bell jar of four litres capacity partially filled with nitrous oxide, for one minute; it was then removed and the inhaler placed directly over the nose. During the first four minutes, there was spasmodic breathing, the heart beating at 134 beats per minute and the respiration being 92. At the end of four minutes, the rat stopped breathing for thirty seconds; life was restored by removal of nitrous oxide and by careful manipulation of the chest. The heart beats rapidly increased up to 216 per minute and the respiration reached 78. Blood was obtained from the tail before the gas was administered and from the heart at the close of anesthesia.

Rat 2. Tame, weight 65 grams. In this rat, the heart beats were 136 per minute and there was a rapid increase to 200 and over per minute during the five minutes the animal was under observation before any anesthesia was given. The little animal showed great susceptibility to its environment. Death resulted two minutes after nitrous oxide was administered. Blood was obtained from the tail before gas was given and from the heart at the close of anesthetization. The erythrocytes showed an increase of 25% after the anesthetic was given and the leucocytes showed a decrease of 11%. There was a marked increase of 31.5% in the small lymphocytes.

Rat 3. Tame, weight 65 grams. Nitrous oxide and oxygen was administered for one-half hour, at the close of which time death resulted immediately. The heart continued to beat for one minute and forty-five seconds after respiration had ceased. Blood was obtained from the tail before anesthesia and from the heart after death had occurred. The erythrocytes gave an increase of 7% and the leucocytes of 29% during the administration of gas. A decrease of 5% in the small lymphocytes was also noted.

Rat 4. Wild, weight 1 lb., 12 ozs. This rat was so large and vicious that it was anesthetized with ethyl chloride six hours before the blood studies were made, so as to enable the operators to secure the animal in a safe position for work. Death resulted two minutes after anesthetization with nitrous oxide and oxygen. The rat was found to be pregnant and tubercular spots were present in lungs, liver and kidneys. Blood was obtained from the tail before and from the coronary arteries after the gas was administered. The erythrocytes showed an increase of 2% and the leucocytes remained practically unchanged.

Rat 6. Wild. Remained under the anesthetic eight minutes before death occurred. Blood was obtained from the tail previous to the administration of gas and from the heart after gas had been given. There was a marked decrease in erythrocytes, amounting to 39% and an increase of 84% in the leucocytes at the time of death. The large lymphocytes showed an increase of 6% and the polynuclear neutrophiles a decrease of 25%.

Rat 7. Wild. Died one minute and forty-five seconds after nitrous oxide and oxygen was administered. Blood was obtained from the tail before and from the heart after the anesthetic. The erythrocytes showed a decrease of 40% and the leucocytes a decrease of 30%. There was an increase in lymphocytes of 5.9% and in polynuclear neutrophiles of 20%.

Rat 8. Wild. Died two minutes after gas was administered.

Rat 9. Wild. Died three minutes after gas was administered. The heart beat for nine minutes after respiration had apparently ceased. Blood was obtained from the tail before the anesthetic was given and from the artery lying just above the heart after anesthetic had been removed. The erythrocytes showed a decrease of 19%, the leucocytes a decrease of 17% and the small lymphocytes of 7.3%

Rat 10. Wild. This rat escaped after the first specimen of blood had been withdrawn.

Rat 11. Wild. Died after being under gas for two minutes. Blood was obtained from the tail immediately before anesthetization. No counts were obtained after death.

Rat 12 and 13. Wild. These rats were killed by sudden trauma and their brains, long bones and organs were removed and prepared for histological examination.

Rat 14. Wild. Died after being under the anesthetic one minute. Blood was obtained from the tail before anesthesia and from the heart immediately after death. The erythrocytes showed a marked diminution in numbers after the anesthetic was administered a decrease of 27% being noted. The leucocytes also were reduced in numbers, 20% less being found at the close of anesthesia.

Rat 15. Wild. Death occurred after being under nitrous oxide and oxygen for thirty-one-minutes. Blood was obtained from the tail before the anesthetic was given and from both the tail and the heart immediately after death. There was an increase of 17% in the number of erythrocytes after the anesthetic had been removed, and a decrease of 40% in the number of leucocytes. Blood was also obtained from the heart immediately after death and a count made of both red and white cells. There was found to be 1,040,000 less erythrocytes in the blood from the heart than in the blood from the tail. The number of leucocytes were the same in both heart blood and blood from tail at the end of anesthesia.

Rat 16. Wild. Rat was accidentally choked, owing to the heavy gloves of operator, after the first count was taken.

Owing to the difference which was found in the number of red cells in the blood from the tail and in the blood from the heart in Rat 15, a few more comparative studies were undertaken so as to determine if possible whether this was merely an occasional occurrence or whether it was the usual condition in the animal under investigation. Accordingly, three tame rats were obtained approximating each other closely in weight and a count was made of the red and white cells in the blood drawn from the tail immediately before anesthesia and from the tail and heart immediately after death occurred. It will be seen by reference to Tables 7-9 that there was no marked difference in the counts of red cells made upon the blood from the tail and the blood from the heart; in two of the rats there was a slightly higher count in the blood from the tail and in one rat, the count was somewhat lower. These differences, however, lie within the limit of possibilities for the blood stream is a living unit and numerical counts from the same point are not necessarily exactly the same at any two given periods of time. It will be seen that in every case, there is a decrease in the number of red cells at the end of anesthesia.

Rats 17 and 18. Tame. The little animals were placed at the same time under a bell jar having a capacity of four litres and gas-oxygen was given by running the supply tube under the jar and pushing it up to a height of three inches within the jar. Air was excluded by placing towels around the lower part of the bell jar where it was raised for the entrance of the supply tube. The nitrous oxide was administered as follows:

Time	Nitrous Oxide—Parts	Oxygen—Parts
3′ 53″	70	30
3′ 56″	75	25
3′ 59″	80	20
4′ 02″	85	15
4′ 18″	90	10
4′ 36″	100	Air and oxygen entirely cut off
4′ 38″	Both rats collapsed	

Rat 17 was removed from the bell jar after collapse occurred and given a heavier dose of gas; within three minutes death took place.

Rat 18 was removed from the bell jar three minutes after partial collapse had occurred and was given the same amount of nitrous oxide and oxygen as had been previously administered to Rat 17. Death took place in six minutes.

Rat 19. Tame. The rat was placed under a bell jar and gas administered as in the case of Rats 17 and 18. A close inspection was made of this rat during the period of anesthesia and some rather interesting data were obtained as will be seen by the study of the following table:

Time, A. M.	Reaction to Anesthetic
9.55	Normal.
10.00	Slight indication of anesthesia.
10.05	Slight indication of anesthesia but cleaning face with both paws.
10.07	Walked with hesitancy.
10.08	Dragged both hind legs.
10.10	No desire to move and upon external stimulation all sense of equilibrium was lost.
10.15	Deep analgesia.
10.25	Dragged left side in an effort to move the body.
10.30	Slight amount of air admitted.
10.35	No attempt made to move. Breathing very labored.
10.40	Slight amount of air admitted.
10.42	No attempt to move. Breathing labored.
10.45	Rat expired.

The nitrous oxide was administered as follows:

Time	Nitrous Oxide—Parts	Oxygen—Parts
9.45	50	50
9.55	80	20
10.00	85	15
10.05	87	13
10.07	88	12
10.08	87	13
10.25	88	12
10.42	90	10
10.45	91	9

Observation of the manner in which these little animals expired suggests some radical change in the respiratory centres. Respiration ceased about as quickly under a small dose of nitrous oxide and oxygen which was gradually increased as it did under a large dose with consequent sudden death. The heart continued to beat from three to thirteen minutes after the entire cessation of respiration.

Rats are not very serviceable animals for study under anesthesia. The tame rats are rather too small and susceptible to their environment to be anesthetized successfully and the wild rats have their powers of defense so highly developed that they fight to the end and even when in an apparently collapsed state, will suddenly and most unexpectedly sink their teeth deeply into the glove of the operator.

Conclusions.

It is quite evident that certain definite changes occurred in the blood during anesthetization with nitrous oxide and oxygen.

A study of the average obtained from the counts made upon human subjects (see Chart 1) shows that there was a marked difference in the numbers of erythrocytes and leucocytes before and immediately after anesthesia; an average decrease of sixteen per cent. having been found for the red blood cells and an average increase of sixteen per cent. for the white blood cells. The polynuclear neutrophiles showed an average decrease of seven per cent. and there was an average increase of twelve per cent. in the small lymphocytes, four per cent. in the large lymphocytes and sixteen per cent. in the transitional forms.

The percentage of hæmoglobin also showed a tendency to decrease during anesthesia and the time required by the blood for coagulation was considerably shortened.

Studies made upon the blood of rats during anesthetization with nitrous oxide and oxygen confirmed the changes found in the blood of human subjects during anesthesia.

Again referring to Chart 1, it will be seen that the blood of the rats showed an average decrease of sixteen per cent. in erythrocytes immediately after the anesthetic was removed and an increase of twenty-four per cent. in leucocytes. The polynuclear neutrophiles gave an average decrease of fifty-nine per cent. as did also the large lymphocytes, whereas, an average increase of six per cent. was found in the small lymphocytes and of fifty-seven per cent. in the transitional forms.

Work, when accompanied by perspiration, causes an increase in the red blood cells and in the percentage of hæmoglobin. During anesthesia with nitrous oxide and oxygen, there is usually marked perspiration, and a physical state resembling the fatigue which follows work is evinced by the patient. In all the cases studied, the changes in the blood, which usually accompany work, are not manifested. On the contrary, quite the opposite is found to occur; a considerable loss of red cells taking place within a few moments.

The question naturally arises how are these red cells being disposed of; are they being rapidly destroyed by the spleen or are they being broken up into blood platelets?

Further question also arises as to the condition of the marrow of the long bones; is there to be found in these factories of the red cells a rapid increase in the manufacture of erythrocytes. Is the marrow crowded with nucleated cells and microcytes and is there a change in the other constituents of the red marrow?

A study of the brain would also seem to be indicated to determine what changes, if any, take place there. Again, interest centers around the heart, lungs, liver and kidneys; what changes, if any, occur in these organs in deep anesthesia.

At present, these questions cannot be answered but a careful study is being made of the brain, bone and internal organs of the rats dying under anesthesia and a report upon these studies will be given at a future date.

Further work will also be done upon large animals which will include a study of blood platelets.

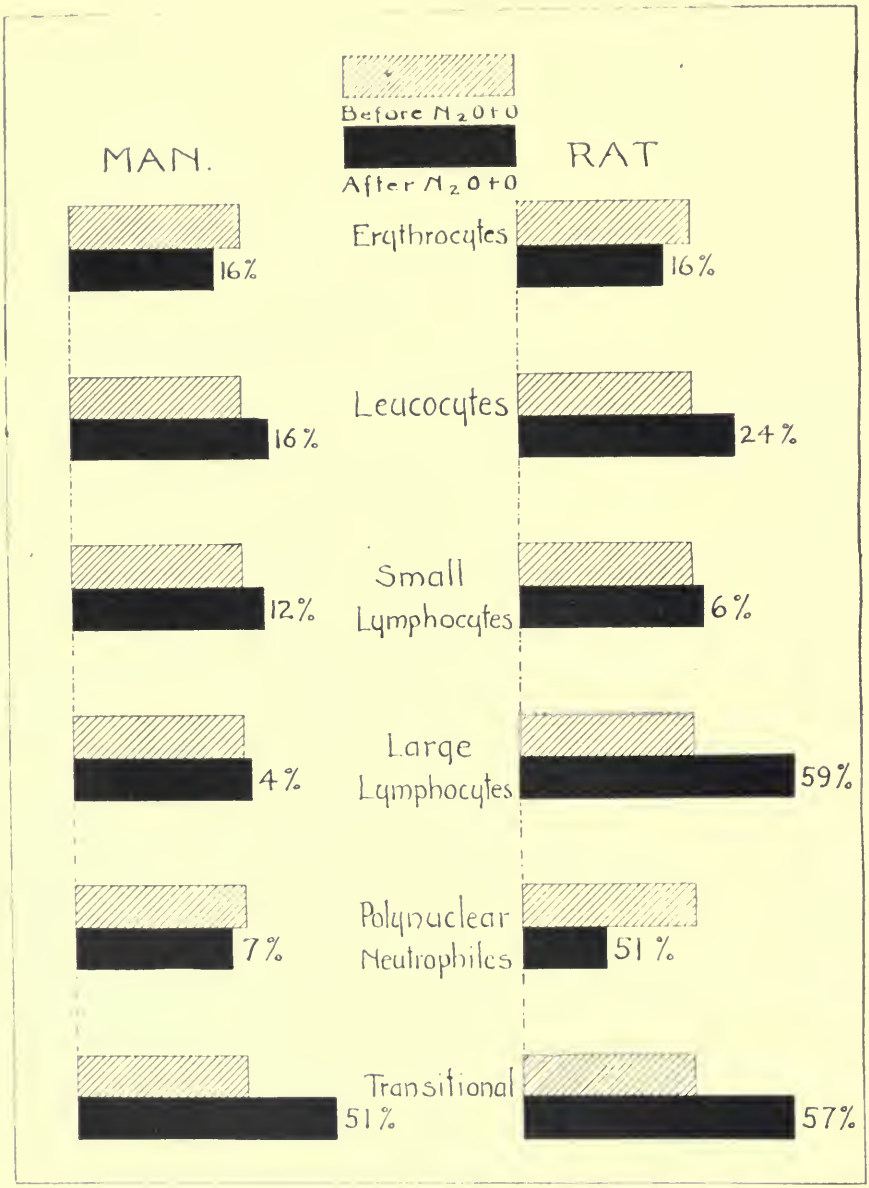
Before N_2O+O
After N_2O+O
MAN.
RAT
Erythrocytes
16%
16%
Leucocytes
16%
24%
Small Lymphocytes
12%
6%
Large Lymphocytes
4%
59%
Polynuclear Neutrophiles
7%
51%
Transitional
51%
57%

CHART I.

TABLE I

No.	Case	ERYTHROCYTES: Immed. Before N_2O & O.	Immed. After N_2O & O.	Percent. Decrease	Percent. Increase	After Nitrous Oxid and Oxygen: Time		Percent. Decrease	Percent. Increase	LEUCOCYTES: Immed. Before N_2O.& O.	Immed. After N_2O&O.	Percent. Decrease	Percent. Increase	After Nitrous Oxid and Oxygen: Time		Percent. Decrease	Percent. Increase
1	Mr. P.	3,688,000	3,424,000	7	....	.....	.....	....	.....	7,500	8,500	....	13	.....	.....	....	.....
2	Miss B.	4,488,000	3,800,000	15	....	.....	.....	....	....	5,500	8,500	....	54	.....	.....	...	.....
3	Miss R.	4,316,000	4,528,000	....	4	10 mins.	4,772,000	....	10	6,500	9,500	....	46	10 mins.	5,500	15	....
4	Mrs. H.	4,640,000	3,360,000	22	....	.....	.....	....	....	10,000	10,000	....	....	.....	.....	....	....
5	Mrs. C.	3,528,000	3,128,000	11	....	2½ hrs.	4,640,000	....	31	6,500	6,500	....	....	.....	.....	...	....
6a	Miss W.	2,928,000	4,008,000	....	36	40 mins.	3,524,000	....	20	12,000	15,500	....	29	40 mins.	9,500	20	....
6b	Miss W.	4,248,000	3,036,000	....	28	20 mins.	3,736,000	....	12	12,000	5,500	54	....	20 mins.	9,000	25	....
7	Miss P.	4,048,000	4,020,000	7	....	1 hour	4,084,000	....	....	5,000	7,500	....	5	1 hour	8,000	....	6
8	Miss E.	4,276,000	4,720,000	....	14	2 hours	4,484,000	....	48	7,000	15,500	....	12	2 hours	16,000	....	12

TABLE II

No.	Case	HAEMOGLOBIN: Immed. Before N_2O.& O.	Immed. After N_2O. & O.	After Nitrous Oxid and Oxygen: Time	Percent.	ACTUAL QUANTITY: Immed. Before N_2O. & O.	Immed. After N_2O. & O.	After Nitrous Oxid and Oxygen: Time	Percent.	COLOR INDEX: Immed. Before N_2O. & O.	Immed. After N_2O. & O.	Immed. After N_2O. & Oxygen: Time	Percent.
1	Mr. P.	77%	82%	.....	....	10.55%	11.23%	.....	.....	1.	1.	.....	....
2	Miss B.	77%	73%	.....	....	10.54%	10.00%	.....	.....	0.8	0.9	.....	....
3	Miss R.	79%	80%	.....	75%	10.82%	10.96%	.....	10.68%	0.9	0.8	.....	0.8
4	Mrs. H.	89%	93%	.....	....	12.19%	12.74%	.....	.....	0.9	1.	.....	....
5	Mrs. C.	83%	85%	.....	....	11.78%	11.64%	.....	.....	1.	1.	.....	....
6a	Miss W.	75%	75%	40 mins.	75%	10.27%	10.27%	40 mins.	10.27%	1.	1.	40 mins.	1.
6b	Miss W.	83%	83%	20 mins.	83%	11.27%	11.27%	20 mins.	11.27%	0.9	1.	20 mins	1.
7	Mis P.	82%	82%	1 hour	82%	11.23%	11.23%	1 hour	11.23%	1.	1.	1 hour	1.
8	Miss E.	85%	85%	2 hours	85%	11.64%	11.64%	2 hours	11.64%	1.	0.9	2 hours	0.9

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TABLE III

No	Case	Ratio between red and white cells: Immed. Before Nitrous Oxid and Oxygen	Ratio between red and white cells: Immed. After Nitrous Oxid and Oxygen	Blood pressure: Systolic	Blood pressure: Diastolic	Time of coagulation: Before Nitrous Oxid and Oxygen	Time of coagulation: After Nitrous Oxid and Oxygen
1	Mr. R.	1.491	1.402	132	85	....	..
2	Miss B.	1.516	1.447	110	75	4′	3′
3	Miss R.	1.664	1.476	120	80	....	....
4	Mrs. H.	1.464	1.336	120	80	....	....
5	Mrs. C.	1.542	1.481	110	70	4′	3′
6a	Miss W.	1.224	1.258	...	..	....	
6b	Miss W.	1.354	1.550	...	..	....	2′
8	Miss E.	.....	.....	...	..	3¾′	2′

TABLE IV

No.	Case	Neutrophiles polynuclear: Immed. Before Nitrous Oxid and Oxy.	Neutrophiles polynuclear: Immed. After Nitrous Oxid and Oxy.	Neutrophiles polynuclear: After Nitrous Oxid and Oxygen: Time	Neutrophiles polynuclear: After Nitrous Oxid and Oxygen: Per-cent.	Small lymphocytes: Immed Before Nitrous Oxid and Oxy.	Small lymphocytes: Immed. After Nitrous Oxid and Oxy.	Small lymphocytes: After Nitrous Oxid and Oxygen: Time	Small lymphocytes: After Nitrous Oxid and Oxygen: Per-cent.	Large lymphocytes: Immed. Before Nitrous Oxid and Oxy.	Large lymphocytes: Immed. After Nitrous Oxid and Oxy.	Large lymphocytes: After Nitrous Oxid and Oxygen: Time	Large lymphocytes: After Nitrous Oxid and Oxygen: Per-cent.	Transitional: Immed. Before Nitrous Oxid and Oxy.	Transitional: Immed. After Nitrous Oxid and Oxy.	Transitional: After Nitrous Oxid and Oxygen: Time	Transitional: After Nitrous Oxid and Oxygen: Per-cent.	Eosinorhiles: Immed. Before Nitrous Oxid and Oxy	Eosinorhiles: Immed. After Nitrous Oxid and Oxy.	Eosinorhiles: After Nitrous Oxid and Oxygen: Time	Eosinorhiles: After Nitrous Oxid and Oxygen: Per-cent.	Basophiles: Immed. Before Nitrous Oxid and Oxy.	Basophiles: Immed. After Nitrous Oxid and Oxy.	Basophiles: Immed. After Oxid and Oxygen: Time	Basophiles: Immed. After Oxid and Oxygen: Per-cent.
1	Mr. P.	94.6%	80. %	.....	.....	0.3%	13. %	.....	.....	.....	2.5%	.....	.....	.....	.....	.....	.....	4.6%	4%	.....	.....	0.5%	0.6%	.....	.....
2	Miss B.	58.3%	58. %	.....	.....	32.5%	32.6%	.....	.....	3.5%	1. %	.....	.....	5. %	6.5%	.....	.....	.....	1.5%	.....	.....	0.6%	0.3%	.....	.....
3	Miss R.	56.6%	48.7%	.....	.....	32.3%	42.6%	.....	.....	1.5%	1.4%	.....	.....	6.2%	3.8%	.....	.....	3.4%	2.7%	.....	.....		0.6%	.....	.....
4	Miss H.	66. %	56.5%	.....	.....	28.7%	35.5%	.....	.....	1.8%	1.3%	.....	.....	1.1%	5.5%	.....	.....	1.8%	1. %	.....	.....	0.6%	0.2%	.....	.....
5	Mrs C.	51. %	56. %	.....	.....	36. %	33. %	.....	.....	.....	3. %	.....	.....	5.3%	6 %	.....	.....	1.4%	2. %	.....	.....	0 2%	.....	.....	.....
6a	Miss W.	56. %	63.3%	40 mins	70.	27.6%	23.3%	40 mins.	21.6	3. %	2.3%	40 mins.	0.7	10.7%	6 %	40 mins.	6.3	1.4%	1. %	.....	.....	1.2%	1. %	40 mins.	0.3
6b	Miss W.	59. %	54. %	20 mins.	55.	28.6%	32.5%	20 mins.	34.4	4.6%	1.5%	20 mins.	3.6	5. %	11. %	20 mins.	5.	2. %	1. %	.....	.....	0.6%	....	20 mins.	0.3
7	Miss P.	63.3%	63.7%	1 hour	68.	25. %	15. %	1 hour	19.4	3. %	8. %	1 hour	0.7	7.2%	10.3%	1 hour	10.4	1.2%	2. %	.....	.....	0.2%	1. %	1 hour	1.
8	Miss E.	83. %	73.1%	2 hours	88.1	7.2%	19. %	2 hours	6.4	4.3%	2.2%	2 hours	0.5	4.6%	4.1%	2 hours	4.1	0.5%	1.2%			0.3%	0.2%	2 hours	0.5

TABLE V

POLYNUCLEAR NEUTROPHILES—SEGMENTS

No.	Case	ONE SEGMENTS				TWO SEGMENTS CONNECTED				TWO SEGMENTS				THREE SEGMENTS				FOUR SEGMENTS				FIVE OR MORE SEGMENTS			
		Immed. Before N.² O.	Immed. After After N.² O. & O.	After N.² O & O.		Immed. Before N.² O. & O.	Immed. After N.² O. & O.	After Nitrous Oxid and Oxygen		Immed. Before N.² O. & O.	Immed. After N.² O. & O.	After Nitrous Oxid and Oxygen		Immed. Before N.² O. & O.	Immed. After N.² O. & O.	After Nitrous Oxid and Oxygen		Immed. Before N.² O. & O.	Immed. After N.² O.	After Nitrous Oxid		Immed. Before N.² O.	Immed. After N.² O.	After Nitrous Oxid	
				Time	Per-cent.			Time	Per-cent.			Time	Per-cent.			Time	Per-cent.			Time	Per-cent.			Time	Per-cent.
3	Miss R.	8.3%	21.4%	.....	.....	13.8%	7.3%	.....	.....	49.7%	55.3%	.....	.....	25.8%	15.2%	.....	.....	2.3%	0.6%	.....	.....	.....	.....	.....	.....
6a	Miss W.	11.3%	7. %	40 mins.	9. %	9.2%	12. %	40 mins.	6.7%	49. %	53.5%	40 mins.	58.4%	27. %	23. %	40 mins.	21.4%	3. %	4.5%	40 mins.	4.3%	0.5%	8.3%	40 mins.	74.8%
6b	Miss W.	5.5%	3. %	20 mins.	11. %	2.1%	.....	20 mins.	2. %	48.2%	44. %	20 mins.	52. %	36.3%	48.5%	20 mins.	33. %	6.2%	4. %	20 mins.	2. %	1.5%	0.5%	.....	.....
7	Miss P.	11. %	7.2%	1 hour	4.3%	18.6%	13.6%	1 hour	12. %	41. %	49.5%	1 hour	59.3%	25.1%	26.6%	1 hour	22.5%	3.3%	2.5%	1 hour	1.4%	1. %	0.4%	1 hour	0.4%
8	Miss E.	10. %	14.3%	.....	.....	21.3%	12.6%	.....	.....	46. %	55.1%	.....	.....	20.3%	16. %	.....	.....	2.3%	2. %	.....	.....	.....	.....	.....	.....

TABLE VI

RED BLOOD CELLS

No.	Rat	Tail Before Gas	Tail After Gas	Percent. Decrease	Percent. Increase	Heart Later	Percent. Decrease	Percent. Increase
17	Tame	5,328,000	3,072,000	42%	....	3,062,000	42%	....
18	Tame	3,844,000	3,144,000	18%	....	3,062,000	23%	....
19	Tame	5,096,000	2,448,000	51%	....	2,736,000	46%	....
				Average 43%			Average 41%	

WHITE BLOOD CELLS

17	Tame	3,800	1,700	55%	....	2,400	37%	....
18	Tame	3,800	7,000	....	87%	11,500	....	202%
19	Tame	20,500	23,000	....	12%	6,500	68%	....
				Average 25%			Average 7%	

TABLE VII

No.	Rat	ERYTHROCYTES Immed. Before Nitrous Oxid and Oxygen	Immed. After Nitrous Oxid and Oxygen	Percent. Decrease	Percent. Increase	LEUCOCYTES Immed. Before Nitrous Oxid and Oxygen	Immed. After Nitrous Oxid and Oxygen	Percent. Decrease	Percent. Increase
1	Tame	6,024,000	5,772,000	41%	....	4,000	6,500	....	37%
2	Tame	6,552,000	4,864,000	25%	....	8,500	7,500	11%	
3	Tame	6,872,000	7,388,000	....	7%	10,500	15,500	....	42%
4	Wild	3,604,000	3,688,000	....	2%	19,500	19,500	....	
6	Wild	7,084,000	4,312,000	39%	....	3,800	7,000	....	84%
7	Wild	6,096,000	3,632,000	40%	....	5,000	3,500	30%	...
9	Wild	9,216,000	7,424,000	19%	....	4,500	3,700	17%	....
14	Wild	5,776,000	4,176,000	27%	....	5,000	4,000	20%	....
15	Wild	5,176,000	6,096,000	....	17%	5,000	3,000	40%	....
17	Tame	5,328,000	3,072,000	42%	....	3,800	1,700	55%	...
18	Tame	3,844,000	3,144,000	18%	....	3,800	7,000	....	84%
19	Tame	5,096,000	2,448,000	43%	....	20,500	23,000	....	12%

TABLE VIII

No.	Rat	SMALL LYMPHOCYTES Immed. Before N.² O.	SMALL LYMPHOCYTES Immed. After N.² O.	LARGE LYMPHOCYTES Immed. Before N.² O.	LARGE LYMPHOCYTES Immed. After N.² O.	TRANSITIONAL Immed. Before N.² O.	TRANSITIONAL Immed. After N.² O	POLYMICLEAR NEUTROPHILES Immed. Before N.² O.	POLYMICLEAR NEUTROPHILES Immed. After N.² O.	EOSINOPHILES Immed. Before N.² O.	EOSINOPHILES Immed. After N.² O.
1	Tame	73. %	55. %	8.2%	4. %	6.4%	13. %	12. %	28. %	0.3%	.....
2	Tame	34. %	65.5%	8.6%	2.1%	3.4%	7.7%	54. %	22.5%	.....	2.1%
3	Tame	48.5%	48. %	7.5%	2.8%	1.2%	1.9%	42.8%	47.3%	.....	.....
4	Wild	38.6%	39. %	8. %	6.5%	5. %	2.3%	48.2%	52.2%	0.2%	.....
6	Wild	39.7%	45.3%	6.3%	13. %	2. %	4.7%	51.5%	36.5%	0.5%	0.5%
7	Wild	51.7%	67.6%	4. %	5.2%	4.5%	5.2%	39.2%	19. %	0.5%	3. %
9	Wild	76.7%	69.4%	4.3%	10.6%	0.5%	4.6%	17.3%	14.2%	1.2%	1. %

TABLE IX

No.	Rat	HAEMO-GLOBIN		ACTUAL QUANTITY		COLOR INDEX		RATIO BETWEEN RED AND WHITE CELLS	
		Immed. Before N.²O. & O.	Immed. After N.²O. & O.	Immed. Before N.²O. & O.	Immed. After N.²O. & O.	Immed. Before N.²O. & O.	Immed. After N.²O. & O.	Immed. Before N.²O. & O.	Immed. After N.²O. & O.
1	Tame	120%	120%	16.44%	16.44%	1	1	1.1560	1.888
2	Tame	120%	120%	16.44%	16.44%	0.9	1	1.770	1.648
4	Wild	.....	.....	.....	.....	.....	.....	1.184	1.189
6	Wild	.....	.....	.....	.....	.....	.....	1.1864	1.616
7	Wild	.....	.....	.....	.....	.....	.....	1.1219	1.1037
9	Wild	.....	.....	.....	.....	.....	.....	1.2048	1.2006
17	Tame	.....	.....	.....	.....	.....	.....	1.1402	1.1807
18	Tame	.....	.....	.....	.....	.....	.....	1.1011	1.449
19	Tame	.....	.....	.....	.....	.....	.....	1.248	1.106

In closing, the author wishes to acknowledge his indebtedness to Dr. E. Q. St. John, through whose assistance and interest, abundant opportunities were afforded for the furtherance of the work.

Anomalies in Pulp Structure and Their Relation to Clinical Work.

By Dr. V. A. Latham, Rogers Park, Chicago, Ill.

The human dental apparatus is called anisodont, because of the difference between the incisors and the molar teeth, a characteristic which it shares with the majority of the mammals. On the other hand, teeth in man lie adjoining each other and form rows in which no diastem is found, an arrangement which is not seen in many animals and which none of the primals have in common with the human. All of the various types of teeth may blend with each other and become complex through the addition of grooves and cusps of many kinds. We are then confronted with the question as to the nature of evolutional changes which the teeth pass through before reaching the present stage of high differentiation.

Those who accept Lyell and Darwin's teachings agree that the adding together of all the small changes which occur from time to time, finally amount to great differences in the forms of all living creatures and their teeth. There exists no fixed type; no state of perpetuation, in Nature; all forms of life are either passing *into* or *out* of existence.

When primary teeth are replaced by a new set of teeth, the latter is made up of a greater number and larger than the temporary ones. Hence any condition which may cause a difference in their growth or position must create changes in the teeth and their elements. Mastication, motion of the jaws, cause changes and their occlusion becomes altered. These, then, are likely to continue by having the nutritional centres changed, and as a result of this disturbed vascular and nervous supply, pathologic conditions arise, if not immediately, then later in life. (Figs. 8, 9, 35.)

Who does not know of the future influence upon the density of teeth through poor tooth structure found in the first year of rachitic and marasmic children with their attendant poor oxidation and anæmia? The erosive and exceedingly hypersensitive molars with vague odonto-

Fig. 1.

Fig. 2.

Fig. 1—Molar, carious with secondary dentin forming on the same side of the pulp chamber and near apex of that root; cementosis on the other root and root filling up with deposits.

Fig. 2—(Pulp). Three abscesses in a supposed healthy pulp shows also myclin degen. (Wallerian) of nerve fibres and fatty deg. areas through pulp (rare).

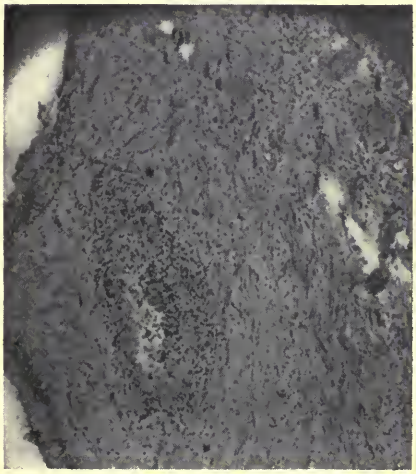


Fig. 3.

Fig. 4.

Fig. 3—Pulpitis with abscess under cervical margin by odontoblasts; this condition has been denied as occurring in living pulps, but is shown here with nerve fibre or "Wallerian" and fibroid degeneration; also see Fig. 45.

Fig. 4—Pulp calcified. Crown.

Fig. 5—Developing pulp, dentin, enamel organ—epithelial cord.

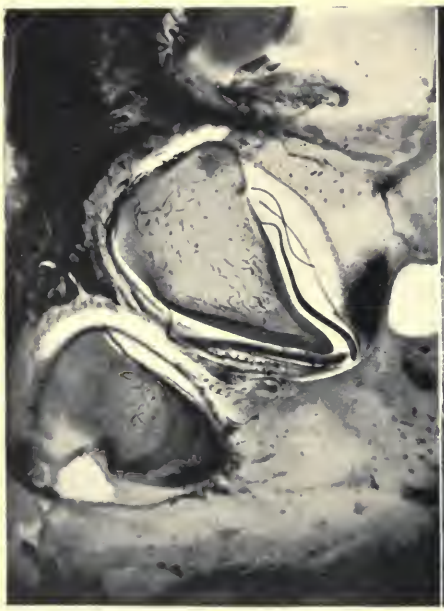


Fig. 6.

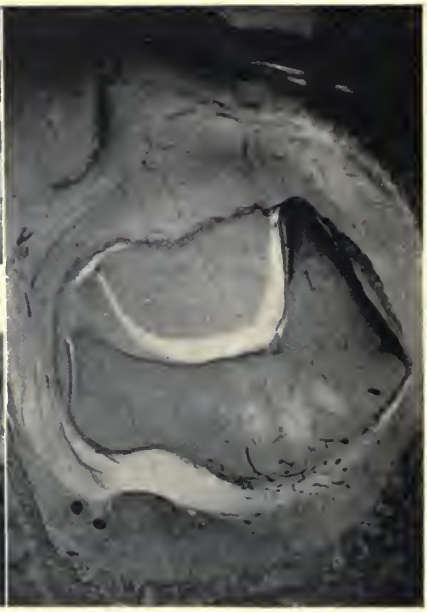
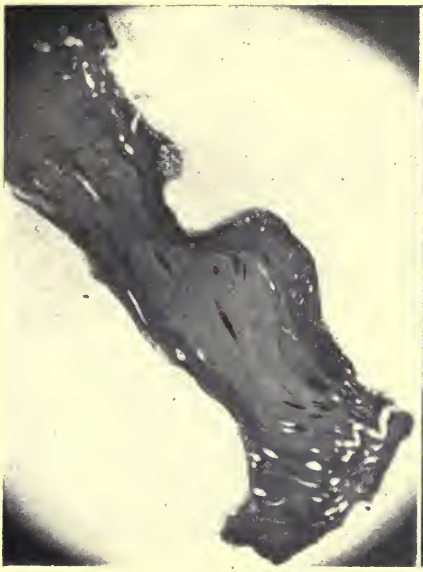


Fig. 7.

Fig. 6 Development of cuspid; gradual narrowing of pulp, beginning cement layer infold. (injected).

Fig. 7 Developing molar in situ. Pulp injected, one horn calcified earlier than the other. Epithelial cord. Periosteum, Bone.

Fig. 6 is unavoidably turned sidewise.—EDITOR.



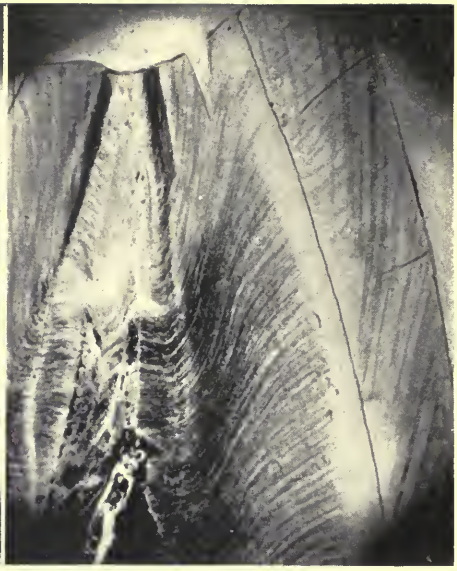


Fig. 8. Fig. 9.

Fig. 8—Fibroid pulp, with varicosities, nerve and fatty degeneration.

Fig. 9—Human cuspid. Secondary dentin. Striae of Retzius. Crown of tooth, absorption growth in pulp canal. Interglobular spaces.

Fig. 10. Fig. 11.

Fig. 10—Pulp stone, "so-called," but is secondary dentin filling pulp chamber—may be a "vestigial remains."

Fig. 11—Shows peridental vessels. Pulp of young tooth, showing *calcareous deposit* or embryonic *remains* in it. Compare with 29, 30 and 34.

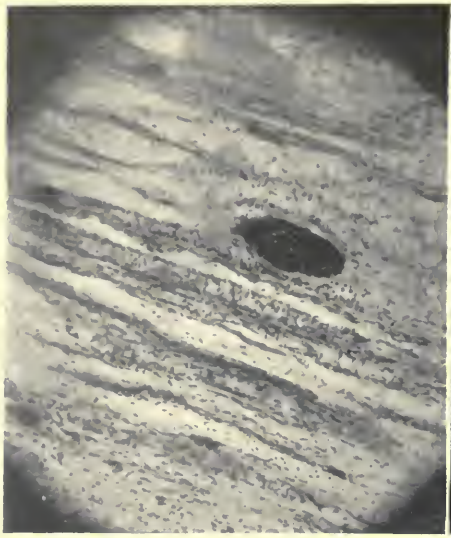


Fig. 12.

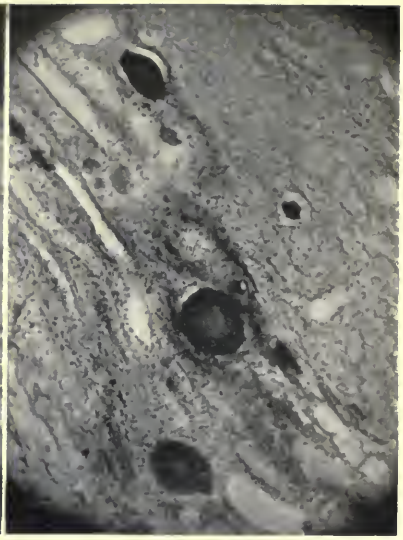


Fig. 13.

Fig. 12—Slight pulpitis; arteritis with a calcific nodule near vessels causing irritation of nerve.

Fig. 13—Pulp (a) clody swelling. (b) Oedematous or parenchymatous degeneration. Few nerve bundles seen. *Pulp stones.*

Fig. 14.

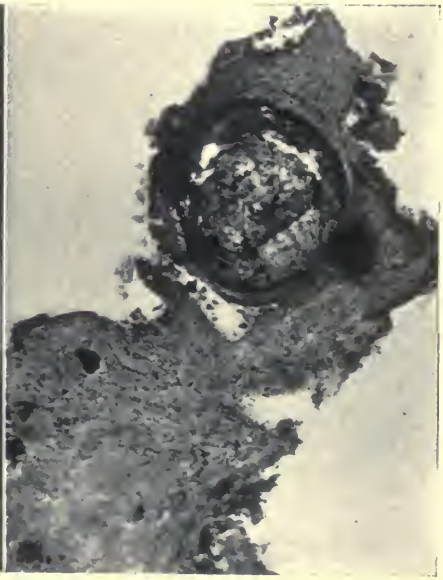


Fig. 15.

Fig. 14—Calcosphérite (Sponge spicule type) x 143 T. S. Pulp with a *calco-sphérite* showing fibrous tissue with the cells in a state of granular and fatty degeneration and poor staining reaction.

Fig. 15—Globular pulp stone and smaller ones—chronic interstitial pulpitis.

logic symptoms often described as "earache." This pulp irritation if not watched soon causes pericemental and gingival signs which are frequently not treated, as the physician pays little attention to the oral cavity and the dentist is too much feared by both parents and child. (Figs. 1, 2, and 3.)

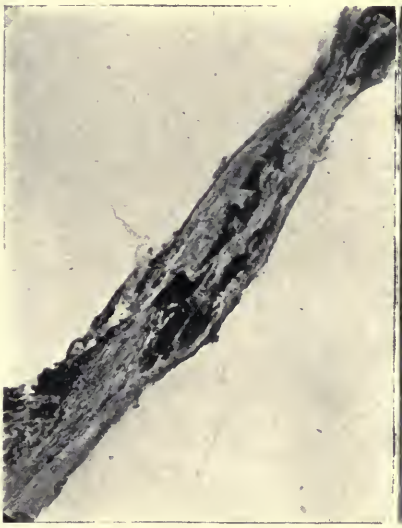


Fig. 16.

Fig. 17.

Fig. 16—Fibroid and calcareous degeneration. Compare this type of deposit with Figs. 8-15, 22, 45, 46.

Fig. 17—Showing sharp bur-like projections of dentin into pulp chamber.

The mistaken delay even yet in having early attention given the young is a most deplorable feature in our professional experience, besides lack of cleansing. Parents hardly believe you when you point out that the carious molar with its dead and putrescent pulp is really the permanent tooth. The regret, then, is too late, and it seems to me that physicians should be urged to warn young mothers of the danger to children, and urge that they understand the early care of the mouth or else consult their family dentist.

Modern Dentistry!

A boy, aged twelve years and eight months, came in recently for treatment. His dentist told his father the mouth was too crowded, and insisted on the extraction of some teeth "to make room."

He removed the lower first permanent molars, the second premolars and cuspids which had just erupted from the mandible! The upper first molars are now tipping and dropping very low and mastication is impossible through lack of occlusion. Yet these are modern dentists! No wonder the lad cannot get strength and prevent anæmia.

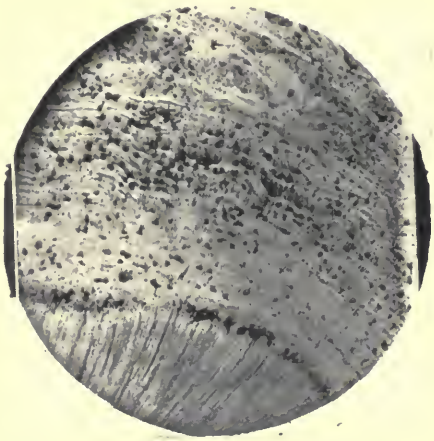


Fig. 18—Hypercementosis with granaular layer of Pürkinje, Sharpey's fibres. Dentin.

Observations of Ancients.

Even Hippocrates (460-355 B. C.) spoke of the son of Matrodor developing acute gangrene of the jaw after a toothache. The swelling of the gums became purulent and the teeth and the bone were destroyed. This is evidently one pulpal result from its picture. Claudius Galenus (131—200 A. D.) must have been a physician and dentist or a true scientific observer. It was through him a differentiation between disease of the pulp and that of the peridental membrane was first noted. His own personal sufferings from a painful tooth with its pulsation so closely resembled inflammation of the soft tissues that he was "surprised that a tooth could become inflamed." Then he says: "When I again had toothache I realized that not the tooth, but the inflamed gum was the cause. From which observations I learned that a certain pain may have its seat in the tooth and another in the gum." Eustachius, who was contemporaneous with Ryff in the latter part of the sixteenth century, gave an impetus to the study of the teeth, stating that the interior of the tooth was filled with a pulp, richly supplied with nerves, and also wrote on the anomalies of teeth. (Figs. 5, 6, 23, 36.)

Anomalies in Tooth Formation.

The size and form of the crown as well as the tooth may show many variations.* (Figs. 7, 21.) The roots are especially likely to be the subject of abnormal conditions. Many have noted in their practice upper cuspids with two and even three roots,

Fig. 19

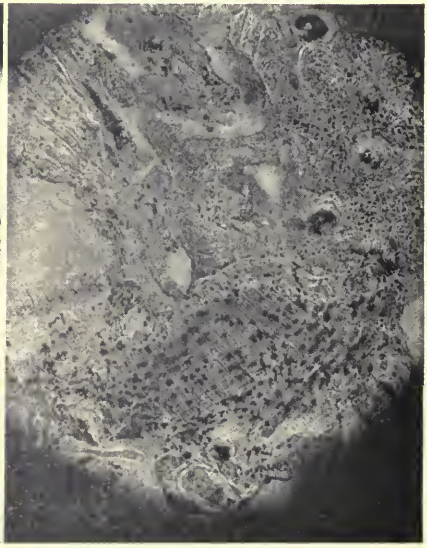


Fig. 20.

Fig. 19—V. S. cuspid and alveolus. Spongy bone. Dentin, cementum, periosteum and Sharpey's fibres.

Fig. 20—Hypercementosis, osteoblasts and osteoclasts; Sharpey's fibres running to tooth.

and upper lateral incisors with two roots; lower cuspids with two roots; the bicuspids show many deviations with hooks and curved ends, some with three roots attached to the first upper bicuspid or premolars.

The molars, as we all know, need careful consideration, for the difficulty is to find two alike; some diverging widely, some having four or five tortuous roots, others curving together and almost forming a ring. Anomalies occur in the position of individual teeth, and these show many changes in the pulp should one be fortunate enough to have the chance of examining a freshly extracted specimen. The peg-shaped teeth are independent and may have been separated from the primary

*"The Forms and Origin of the Teeth"—V. A. LATHAM—*Ohio Journal of Dental Science,* June 1888, p. 257.

tooth germ by mechanical influences. Here the pulps are usually of a fibroid character, lacking in cellular formation and atrophic. (Fig. 8.) Congenital defects of the enamel and dentine affect the pulp, whether it be erosion or hypoplasia; for example, teeth having a worn incisal edge or the serrated form having lateral grooves usually present an unequal

Fig. 21.

Fig. 22.

Fig. 21—Pulp stone from odontoblasts—patient had severe tic-doulereaux and paralysis which stopped on extracting tooth.

Fig. 22—Abscess under odontoblasts and pulpitis in the centre, calcarious deposits. Compare with Figs. 2 and 3.

layer of enamel covering or even a partial absence. (Fig. 9.) Take cases of a syphilitic type; here we meet with one of the most difficult problems in treatment, because of their high degree of sensitiveness, difficulty in making retention grooves owing to close occlusion or attrition, the poor structural character of the chemic and histologic make-up, and a very susceptible pulp and its nearness to the field of operation. The teeth very quickly show signs of pulp disturbance needing early removal. The crowns and roots vary in their calcification (Fig 7), and are discouraging to any clinician or operative worker and usually are lost early. Of course it is needless to point out the constitutional effects on such teeth, for their subjects are usually extreme types of debility and degeneration.

The various events of tooth formation begin at or about the fifth fœtal month, and are shown by the small hood of dentin at the tip of the tooth, and in this example, a molar, simultaneously at different cusps and on the surface of dentin, the ameloblast layer is joined (Figs. 5, 6, 7), which in the early stage is known as the "tooth fragment." As these layers increase in diameter and thickness, the additional deposits of dentin continually decrease the size of the pulp, the development of the enamel externally causes the enamel pulp to atrophy. Calcification of the first teeth varies somewhat, but the table of Dr. C. Y. Pierce, published in Amoedo's *Legal Dentistry* and in the *Dental Cosmos,* is very useful. Pierce gives the seventeenth week, exactly at the time when the posterior tooth band begins the invagination process for the permanent molars. Sometimes these tooth fragments consisting of the dentin and enamel deposits are found in the deciduous teeth and are frequently called "pulp stones"—one of the most troublesome diagnoses to make in children and often causing irritation and grinding of the teeth. (Fig. 11.)

Calcareous Deposits.

Calcareous deposits are found in so-called "normal pulps" in youth—are they normal in the true sense of histological conditions? Are they cell-inclusions or embyronic remains from these calcifying tooth fragments? Are these bodies the same as those found in pathologic pulps or in advancing age? (Figs. 10, 11, 12.)

From what studies I have made, these structures seem to vary in location, in density, in their micro-structure and behavior to staining reagents. Some are granules deposited in between the blood vessels (Figs. 12, 13); some resemble marine sponge spiculæ (Fig. 14); other globules which on sectioning resemble gall-stones by their concentric rings or lamellæ (Fig. 15). Later on in life the pulp tissue can be very dense connective tissue with few, if any, cell elements or simply calcified tissue (Figs. 8, 16 and 46).

We expect to find these dense bodies located only on the coronal portion, where we find them doing their duty in trying to guard the pulpal zone from bacterial, thermal or pathologic changes due to irritation. But some nodules are found along the side of the pulpal canal resembling tiny burs (Fig. 17), others are only found at the apical end of the tooth, and here may be due to developmental errors of inclusion of the cementum, or true bone (Fig. 11). The cement corpuscles have processes longer than the bone corpuscles (Fig. 18), and the Sharpey's fibres run obliquely to the surface of the dentin (Fig. 19). Haversian canals we leave to the bone during youth, but later on when senile changes

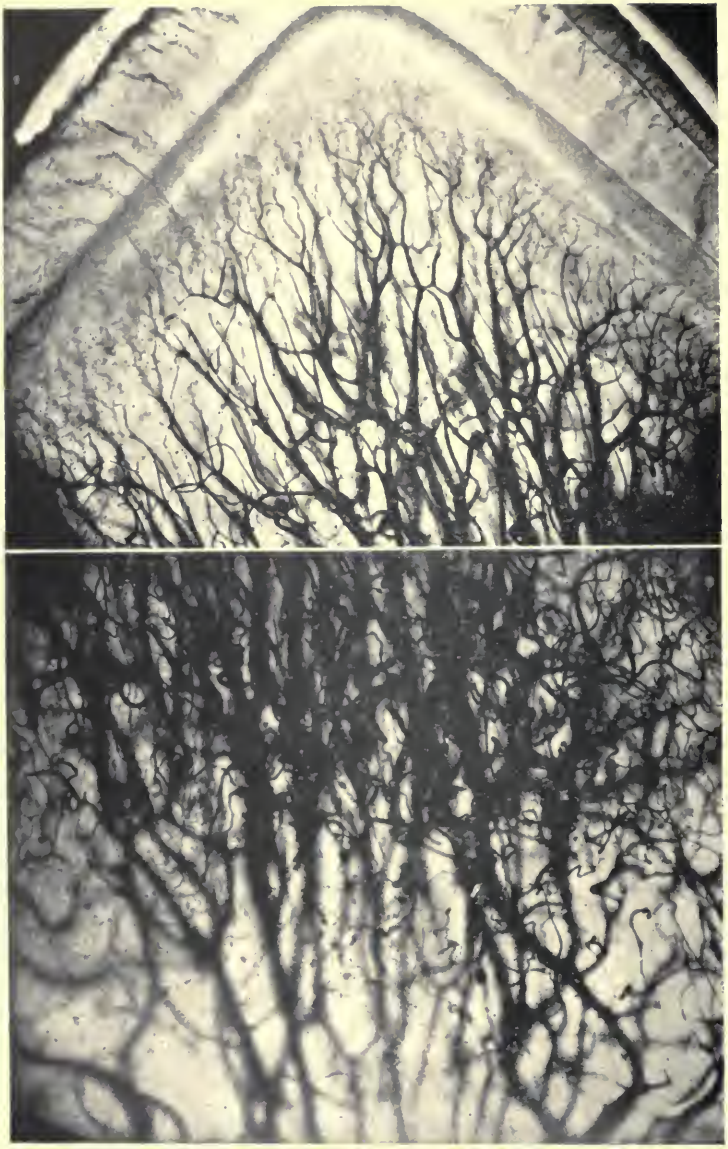


Fig. 23—Injection of a tooth by ordinary method to show pulp vessels passing *into* the *dentin* and *enamel* and their nerve supply with them. Middle portion shows pulp vessels and their vaso-motor plexus. (1889.)

begin they are seen in the cementum and even produce the well-known hypertrophied condition, or hypercementosis (Fig. 20).

How often are these little shining, pin-head masses found on the cervical margins, or along the roots of the teeth wrongly placed in the cementum group, instead of the enamel, adamantoma? These arise from ameloblastic deposits of separated tooth germs which develop slowly in teeth and are congenital. A small dental growth found arising in the pulp cavity becomes an odontoma of the German school (Fig. 10), and

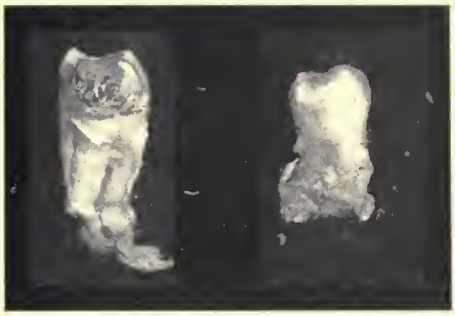


Fig. 24—Granuloma. X-ray did not show these conditions.

also may be seen as an external form originating in the overproduction of dentin during development, or more frequently caused by separated elementary tooth germs which intergrow with true teeth, thus accounting for the osteo-odontoma, or adamantoma.

It is the internal form arising from the odontoblasts that is most important here, as it causes severe odontalgia by growing into the pulp cavity and pressing upon the pulp and its nerve supply should these give symptoms, though they may remain quiescent for a long time, or till abscesses are formed in the pulp (see Figs. 21 and 22).

To operate in these cases a thorough knowledge of the pulpal cavity and root canals is necessary. To those who wish to help their knowledge, the "corrosion" process with Wood's metal is excellent. Another study is by injection and staining the head and neck in experimental cases. If the gelatin is then treated by formal or 10 per cent. bichromate of potash and exposed to the light it becomes insoluble and toughened.

I have used Gerota's method for injection of the pulp with some success, and further study may give better results. (Fig. 23.) (Gerota. *Zur Technik der lymph; gefässinjektion:* 1896. Bd. 12 S. 216 *Anat Anz:*)

A study of metal casts surprises anyone who looks at the diversities in the form of the canals and their anastomasing network. Especially

Fig. 25—Apex of root shows resorption and osteoclastic action—pulp canal closed by calcarious deg. Root resorbed. Incisor.

Fig. 26.

Fig. 27a.

Fig. 27b.

Fig. 26—L. L. first M. distal root all absorbed and decayed away; copper wire imbedded into soft tissues.

Fig. 27a—L. U. 3rd Molar (man). Steel probe outside and nerve probe in root. Patient had several very severe hemorrhages after the extraction had been unsuccessful, and I was called in to stop it in the middle of the night and remove the tooth.

Fig. 27b—R. U. second Bi. (X-ray, woman.) Abscessed. Gutta-percha passed through on account of curve in root and wire had been left upon the split root till I extracted it two years later.

study the buccal and mesial roots of lower molars and upper first molars. The coronal pulp cavity is usually smaller in ratio to the crown, due to the age of the tooth and concentric growth in the solid part of the tooth! Those interested in the more modern methods of examining dental structures should follow the description given by Dr. Hermann Prinz, of Prof. Werner Spaltcholz's method* in the *Dental Cosmos,* Vol. LV, 1913, p. 374.

In our daily work many cases present in which abnormal conditions lie deep seated, even beyond the eye, or sense of touch, varying in

*Ed. M. Nelson, *English Mechanic,* December 1, 1916, p. 370, says: "The method is not due to him but an earlier worker."

their responses to all known diagnostic methods. Even the patient cannot locate the seat of pain, and we must allow for an exaggeration in symptoms. The valuable adjuncts, radiography and stereoscopic photography, must never be allowed to lead one astray by the false images or interpretations (Fig. 24).

Radiographs Not Always Reliable.

The statement that the X-ray proves that a tooth has been filled properly or not is open to question even to-day. We must not forget that some solutions and filling materials *do not show* shadows in all parts of the canals by this method. It depends on the solidity of the filling cones or the chloro-percha or agent used and if metal is used or not. Unless a sufficient quantity of filling material is present to cast a shadow it is usually not reproduced.

The amount of regenerated tissue in the diseased area after inflammation and abscesses cannot always be estimated, as the connective tissue takes a long time before the periosteum and bone are replaced in it, and all light areas around the roots are *not pus,* but may be organizing tissue. One of the most difficult problems I find is to judge the amount of absorption of a root or roots and the possibility that the canals are open at the apices through the filling being resorbed, as in the case of the old chloride of zinc method, or even the more recent chloro-percha retraction and which has not the older lasting properties; or the resorption of the apex by the formal tricresol and other irritant treatments (Fig. 25).

I have extracted teeth where one root of a lower molar has been all resorbed, leaving the fine copper or chloro-percha points in the alveoli extending from the coronal portion (see Figs. 26 and 27). When inflammation has preceded the death of the pulp the periosteum becomes thickened, and also the bony structure; the cementum nodular; this condition should be allowed for in the saving of a tooth and its treatment.

Diagnostic Methods.

Remember, a partially dead pulp will respond to heat and cold even *more* actively than a normal tooth. There may be no pain on cold being applied, but the pain will be intensified by heat applications and is a *very important* point in a discriminating diagnosis. An electric light passed through a tooth with a dead pulp gives an opaque appearance when a live pulp gives a clear image.

Reflecting light from a mirror outside the mouth upon a mirror inside, and from this through the tooth, is nearly as good. Teeth of the premolar type, as well as of the lower laterals, often present faulty canals and are sometimes perforated through the end or side. In such

cases it is best to use hand drills of a high grade for a certain distance only, and then explore with specially made piano wire points filed to the varied thicknesses. If the canal cannot be followed easily, insert a lead post and skiagraph and see whether we are in the right path or dangerously near the apex or side. I frequently meet with fractured teeth of the anterior set which are very thin and flattened. These have been forced open with large drills to take a Davis or Logan post, whether the size of the tooth permitted or not!

Fig. 28—R. C. girl, aged 12—shows curved roots and the reason why her regulating had not been successful and the dangers which drilling may encounter for root treatments. Radiograph by H. L. Lewis, M.D.

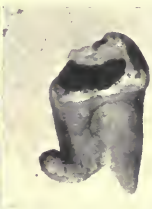
Teeth with roots curved from the normal axis must be considered and not posted in the usual manner for crowning or regulators (Fig. 28). Crowning children's teeth must be carefully done, in view of embryonal bony deposits or cell inclusions in the pulp and the fact that the roots are not yet calcified and having wide and soft foramena.

Here presents one of the problems of modern dentistry; to close these canals safely and yet not interfere with the root growth (Figs. 29 and 30). Within the last few days a lady about forty consulted me at the request of her dentist in regard to saving a left lower second molar which had been under treatment for over four months. Her face had been swollen and all the cervical glands tender. Every time the tooth was even lightly closed it became very sore and elevated. I ventured the opinion that the distal root was at fault with pericemental infection around the third molar, *not* the second molar (Fig. 31). Whenever an abscess forms about a root it nearly always surrounds the apex of the root and destroys the periodontium, thus treatment through the canal is not sufficient and an alveolar opening may be necessary. This

Fig. 29. Fig. 30.

Fig. 29—Root of tooth to show the *vascular supply* and periodontium and the relation to the alveolus. It shows how easily the pulp can be impaired and killed and necrosis occur by the shutting off of the blood supply. Compare Figs. 11, 30 and 34.

Fig. 30—Variety of root from Fig. 4 with calcified pulp. Compare with 29.



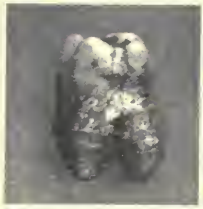


Fig. 31. Fig. 32. Fig. 33.

Fig. 31—Apical granuloma—chronic periodontitis and cementum resorbed.

Fig. 32—Right Lower Molar. Can a perfect root cleansing and filling be made here in the medial apex?

Fig. 33—Exotosis with calcareous deposits (serumnal).

is difficult in the second molar region, and it is sometimes best to force the abscess to localize and open it under nitrous oxide.

A danger presents in some patients of lowered resistance, that the pus may disseminate too freely, and so the operator must try and locate the root with the aid of an X-ray—measure distances and trephine.

Some may advise immediate root filling in such cases, but is it true surgery to do so in the presence of putrescence, blind abscess and septic infection, possibly of the streptococcal type? It is not the pulpal cavity and canals only we must clear and fill; we should disinfect through the dentinal tubuli *into* the enamel and pericementum. Then by high pres-

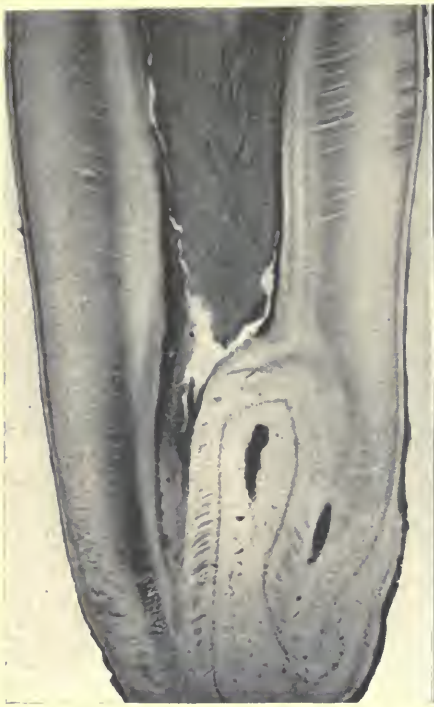


Fig. 34.

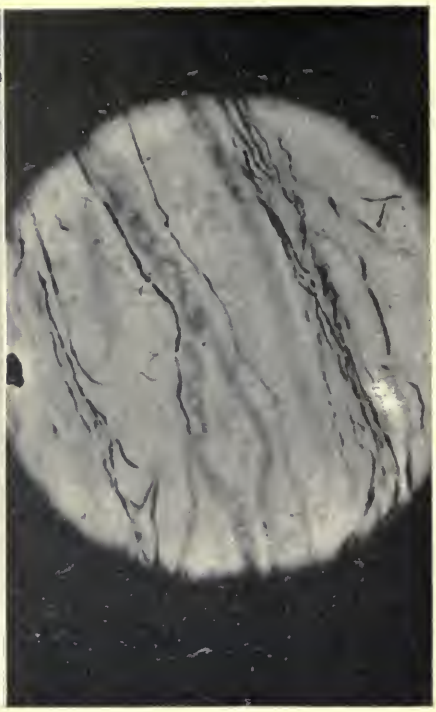


Fig. 35.

Fig. 34 Shows difficulty of opening the terminal canal and the pulp *in situ*. Section of tooth in acute pulpitis and peridontitis

Fig. 35.—Pulp with hyperæmia—blood vessels and their corpuscles *in situ*, the blackened nerve fibres show the "Nodes of Ranvier" (X) very well; axis cylinders, and their close union with the walls of blood vessels—"vaso-motor" system and case by which stimuli are conveyed to cause pulp irritation.

sure we can follow with our final bland antiseptic, which carries no questionable microbes or chemical irritation, finish our fillings by Dr. J. R. Callahan's successful method of Root Canal Preparation (ITEMS OF INTEREST, 1915), and Use of Rosin Solution (Journal of the Allied Dental Societies, N. Y., March, 1914).

Can All Canals Be Filled?

Can all canals in the teeth be filled? (Fig. 32). From pathological work and even histological I should doubt it in the present state of our knowledge. I do not believe all the numerous anastomosing canals can be found or opened by any method of drilling.* Swabbing with Talbot's glycerol Iodine solution is better

*"The Pathological Findings of Some Diseases of the Teeth and Gums."—V. A. LATHAM, *p.* 819, *Dental Summary*, Nov. 1912.

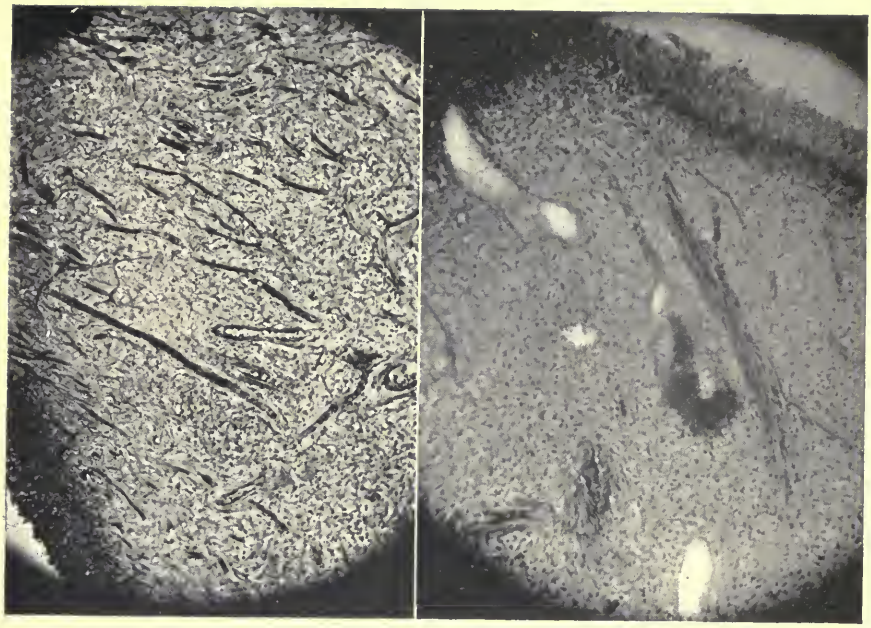


Fig. 36. Fig. 37.

Fig. 36—Odontoblasts. Pulpitis acuta, vessels, fibroblasts.

Fig. 37—Rhexis. Extravasation from vessels, œdema, cell proliferation, early pupitis and thrombus.

than tincture of iodine to locate openings. The packing of débris is difficult to avoid and to clean out in some of these cases sufficiently for any broach or chemical to be worked in to open them thoroughly.

Then there is the question of removal of the coagulum formed by bacterial and pathological conditions which has furnished an obstruction in some cases to perfect penetration by acids, alkalies or other reagents. If this can be accomplished, then antiseptics (provided they *do not coagulate*) have a chance to flow through or permit osmotic action. The structure of cementum and adventitious dentine varies, and from experience with microscopy in dental study offers another problem to secure penetration at the root apex as well as in the presence of "pulp" nodules. Exostosis follows the thickening of cementum through inflammation of the alveolar dental membrane from irritation (Figs. 33 and 34), be it a filling, chemical, or bacterial agents, faulty articulation, etc., etc. In all cases, hyperæmia comes, and this results in some of the sequelæ of inflammation and cell activity (Figs. 35, 36, 37 and 38), causing numerical hyperplasia and so raises the tooth.

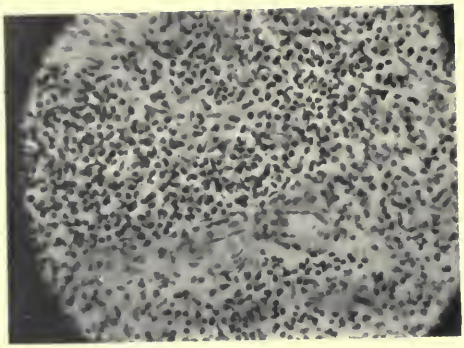


Fig. 38—Pulpitis acuta—cellular proliferation and new forming vessels.

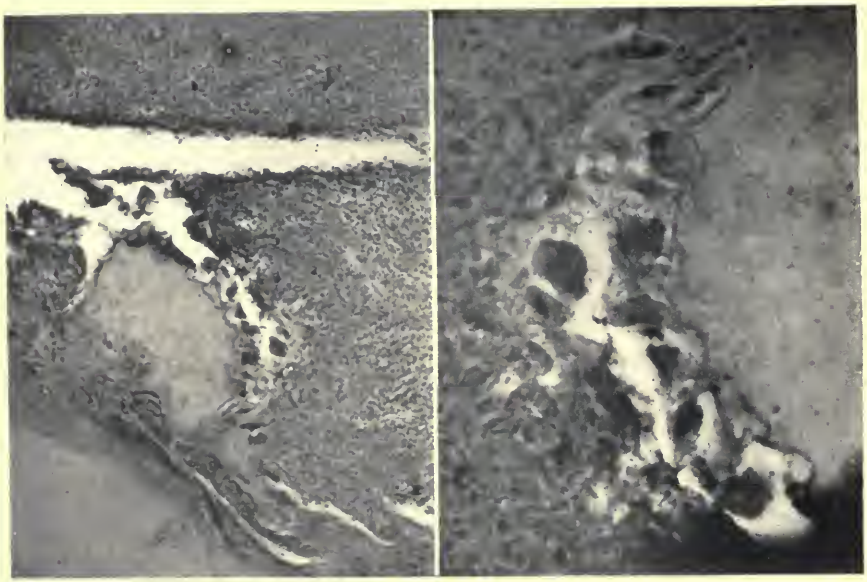


Fig. 39. Fig. 40.

Fig. 39—Peridental membrane. Bone resorption with osteoblasts and osteoclasts in the tooth region near root. Low power.

Fig. 40 Peridental membrane, osteoblasts and osteoclasts at work—magnified higher than Fig. 39.

Tissue Changes Through Pressure.

From pressure we may have two changes—absorption, through cells changing their character from an ordinary nucleated cell to that of a cementoblast or giant cell having absorptive power on the cementum at its contact point (Figs. 39 and 40). If the vascular supply recovers, no further change goes on—but *let* the

irritation *keep up,* and the giant-cells continue their work (Fig. 41). If this becomes chronic, then the cells go on and absorb all the cementum and pass into the granular layer of the dentine in an irregular way on account of the varying density of the tissue through calcification and the penetration of the cementoblasts now changing into cementoblasts

Fig. 41—Resorption of root and the cementum with dentin changed caused by osteoclasts.

and so depositing cementum into the spaces previously produced by the absorption. This can be told by the larger number of lacunæ and canaliculi. If the tissue develops rapidly the number is large and they anastomose with the canaliculi of the surrounding lacunæ; it being the opposite if deposition has been slow. If a chronic abscess is near or pressing on the root we have absorption more general in character and covering larger space than we find in ostosis (Figs. 43b and 43c). The canaliculi of the lacunæ can join the finer branches of the tubuli, forming canals from the cement to the pulp canal even to the pulp itself. Here the dentin changes, odontoblasts alter, absence of the processes passing to the dentin, and instead we get the oval-shaped cell. In this way the transparent zones of micro-sections are made and the vascular supply is restricted and finally cut off. Giant cells develop and some of the canals can be made into one or have irregularities, and in this way

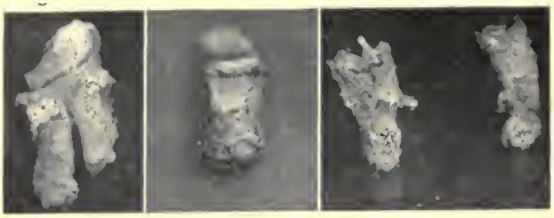


Fig. 42 43a 43b 43c

Fig. 42—Root intrachronic periodontitis and osteoclastic action.

Fig. 43—(a) Abscess and foreign body. (b) Calcified pulp with granuloma. (c) Granuloma with absorption area. Photographed in water after hardening.

Fig. 44 Mrs. S. case. Patient had been advised to have Gasserian ganglion operation as a last resource. Necrosis of alveolar plate into nasal cavity of R. side; excision of infra-orbital nerve. X-ray showed *no* pus or disease. Teeth have been hardened 10 per cent. formol and photographed under water. Largest mass was on the R. U. cuspid and was very large before shrinkage. Granuloma (cystic) with live pulps.

anomalous openings are found filled with débris. Some ask how can we build up and tear down with the same type of cells? It depends on the calcification going on and the chemical nature of the cell just as when the osteoblasts and osteoclasts act in bone formation.

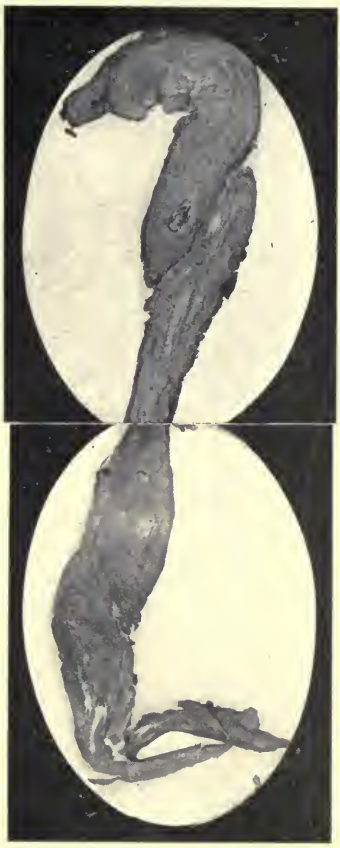


Fig. 45—Subacute interstitial neuritis of the pulp with fibrosis and sclerosis.

Granuloma.

Upon the teeth are found "root cysts" (granuloma), so-called abscesses, and seen on extracted teeth having gangrenous pulps. Malassez and Kirmission found them on wholly intact teeth, possibly due to trauma, causing a hæmatogenous condition. (Fig. 44, Case Mrs. S.)

Grawitz regards them as the end product of a purulent abscess in the granuloma. Partsch, inflammatory new formations, and with Römer

and Malassez, peridental epithelial remnants; Perthes finds persisting epithelial structures. I find some of them to show fibrous tissue, and in a greater proportion according to the variety of irritation as when produced by a high filling.

There being a difference of opinion as regards the vitality of cystic teeth, every operator must consider the special case to be treated. Try

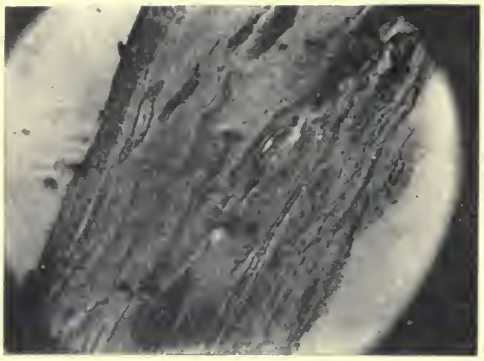


Fig. 46 Fibroid pulpitis or cirrhosis—producing atrophy with pulp stone—note the *"infolding"* near the stone. Stone in end.

out what pulps should be saved and which destroyed. Where cutting the dentin creates sensitiveness and it passes away in a couple of minutes at most, such pulps *can be saved* if with this symptom percussion produces (a) no pain, (b) a disagreeable sensation, (c) no sensation compared to a normal tooth, or (d) a slightly stinging pain; then we have an *intact pulp,* or *simple acute pulpitis.* But if chronic pulpitis, partial or total purulent pulpitis, or painful percussion is found, take out the pulp (Pincemaille—L'Odontologie, Paris, October, 1910). (Figs. 45 and 46.) There is no one rule by which pulp conditions can be known or their treatment be successful! Everyone should learn a careful history of the tooth, and it is well to consider the nine points given by Mr. Hopewell-Smith in the December number of *Dental Cosmos* for 1909.

As illustrating a few pathological findings in pulp canals, these photomicrographs furnish considerable problems for reflection as to histology, pathology, etiology, symptomology, diagnosis and treatment. The subject cannot be so easily dismissed, and it is hoped better scientific reasoning will be done in the chemical side as to the danger of escharotic and violent irritants being forced through and causing so many types of granulomata, absorption of the apices, the false reports of abscesses on

roots *which are areas of regeneration of tissue,* and *not pus,* and so opening and extracting teeth which are by no means the sole or contributary systemic etiologic factor, and so many unknown causes of disease like arthritic endocarditis, biliary and ailmentary infections, etc.

Conclusions. That the canals of every tooth can be opened is as yet doubtful; that roots can be filled in all cases is open to question; that our pathologic work is still needing more study; that the etiology of disease of the oral cavity opens up wide and varied lines of thought due to anomalies in the histology and pathology of the tooth and its pulp cannot be denied. Use caution in interpreting X-ray films, bridging, crowning and violent treatments, and do all possible to urge on some method of *marking* in the schools to encourage oral hygiene as well as in the home.

A Study on the Minute Structures of Human Dentine, Especially on the Relation Between the Dentinal Fibrils and Tubules.

By Dr. Kanaye Hanazawa, Histological Laboratory, Tokyo Dental College.

Literature.

Kölliker (1) in 1852, discovered the possibility of the isolation of the dentinal tubules by means of chemical process, while in 1856, Tomes (2) could isolate the dentinal fibrils by mechanical means.

In 1863, Neumann (3) published his opinion, in which he stated that the dentinal tubules have walls or dentinal sheaths, which have strong resistance against chemical reagents; and they contain dentinal fibrils, or the processes of the odontoblasts. These sheaths are of similar material to the calcified ground substance; and they are readily isolated by the action of acid or alkali. This opinion seems to have been accepted by most scholars in general since then; furthermore, that which is described on this matter in the text books of the present day for the most part comes from the aforesaid work of Neumann.

In 1899, Oskar Römer (4) brought forth the result of his study thus: The dentinal fibrils which are the processes of the odontoblasts are not solid, but tubular in shape, or they form the dentinal tubules, as they are called. In other words, the dentinal fibrils and the dentinal tubules are the same things; they are capable of isolation by the action of acid or alkali. These tubular dentinal fibrils are surrounded with slightly calcified ring-appearing ground substance. In 1909, again Römer expressed the same opinion in the, "*Text zur Atlas der Zahnpulpa nebest Beitragen zur normalen Anatomie von Zahnbein und Pulpa beim Menschen.*"

In the year 1901, Walkhoff (5) insisted "The dentinal tubules which

(1). Kölliker, A., Mikroskopische Anatomie Bd. II, I, Abteil., Leipzig.

(2). John Tomes, On the Presence of Fibrils of Soft Tissue in the Dentinal Tubes, Philosophical Transaction, London.

(3). Neumann, E., Ein Beitrag zur Kentniss des normalen Zahnbein und Knochen Gewebes, Leipzig.

(4). Oskar Römer, Zahnhistologische Studie. Die Köllikerschen Zahnbeinröhrchen und Tomesschen Farsern.

(5). Otto Walkhoff, Die normale Histolegie Menschlicher Zähn, Freiburg.

permeate the ground substance, possess dentinal sheaths of somewhat thick layers and contain the fibrils inside. Besides the dentinal sheaths have bordering layers toward the ground substance." He repeated the same opinion, in 1914, in the *"Neber der feineren Bander Dentinkanälchen."* (6.)

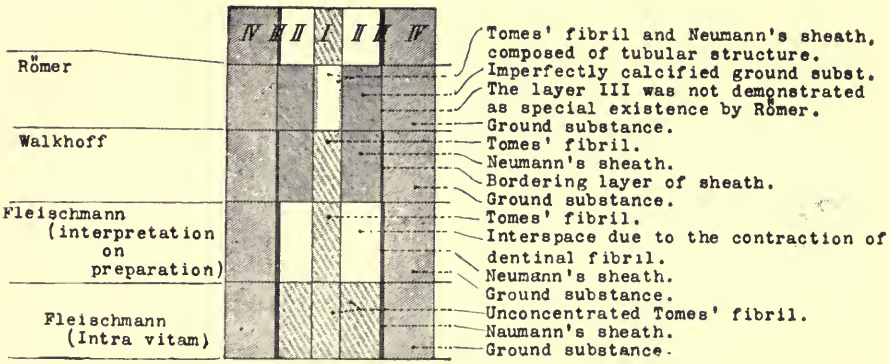


Fig. 1. Scheme to show the structure of dentinal tubules in longitudinal section. (After Kantorowicz.)

On the other hand, Fleischmann expressed the same opinion as that of Neumann in 1905 (7.) He held that the dentinal tubules are small tubular structures penetrating the ground substance of dentin, the walls of which are formed of the same calcified substance, or Neumann's sheaths, as the ground substance is. Inside the tubules, there are solid fibrils or the processes of the odontoblasts. The sheaths have strong resistance to acid and alkali, so that they may be readily isolated. Again he argued the same opinion in the *"Histologie und Histogenese"* (8.)

The writer wishes to comment upon the differences among the opinions of Römer, Walkhoff, Fleischmann by applying two schemes in Kantorowicz's work (9) to save him from entering into further explanations.

In Fig. I, Part I, is of the process of the odontoblasts or dentinal fibril, to which the three scholars make no objection. But Römer considered it is tubular and admits liquid; Walkhoff thought it is simply of solid and fibrillar substance; and Fleischmann believed it to be a fibril which has been contracted due to reagents.

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(6). Otto Walkhoff, Vierteljahrsschrift für Zahnheilkunde, Heft 1.

(7). Fleischmann, Ueber Bau und Inhalt der Dentinkanälchen, Archiv für Mikroscopische Anatomie und Entwicklungsgeschichte. Bd 66.

(8). Fleischmann, Ergebnisse der gesamten Zahnheilkunde, Heft 1.

(9). Kantorowicz, Deutsche Zahnheilknnde in Vorträgen, Heft 21, Seite 43, 1911.

In Part II, Römer regards this part as a portion of slightly calcified ground substance, and insisted this should be compared to the dentinogenic zone. Walkhoff called this part the "Dentinal Sheath" and regarded the sheath as that which has been derived from the transformation of the fibril, and it is easily isolated by chemical or mechanical means. But

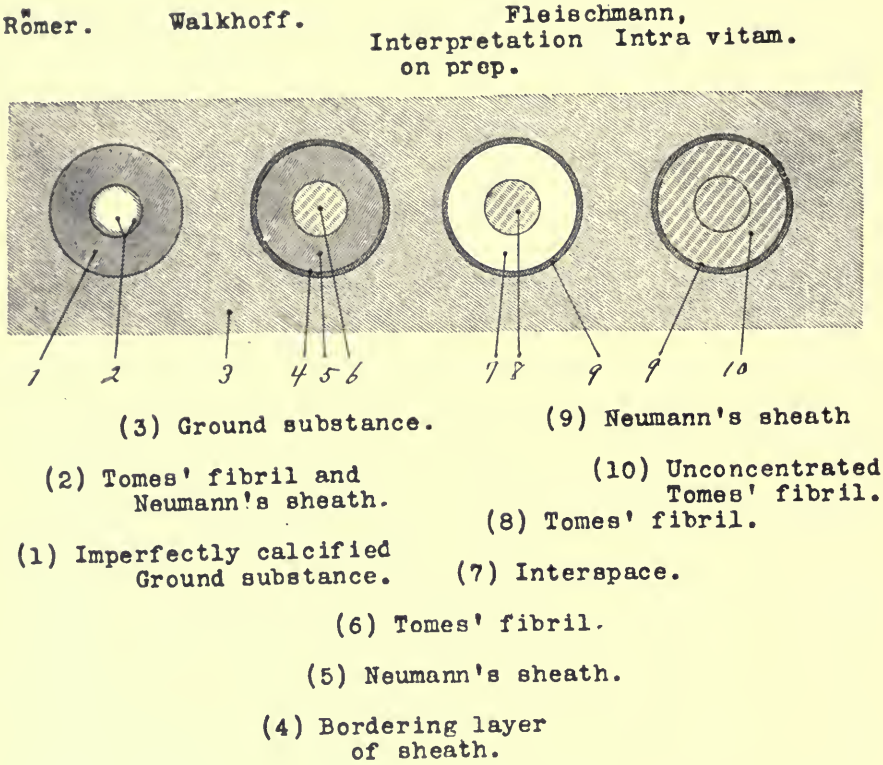

Fig. 2. Scheme to show the structure of dentinal tubules in transverse section.

Fleischmann argued against this view on the ground that this part is an interstice, which has been caused by the contraction of the dentinal fibril and decidedly asserted that it is not of original existence.

Regarding Part III, Römer denied the existence of this layer, while Walkhoff termed that part the bordering layers of the dentinal sheath, and considered it weak in resistance to acid or alkali. Fleischmann called the layer the dentinal sheath, which he believed can be isolated by chemical or mechanical methods.

The writer will now criticize these several opinions of the preceding scientists and introduce his own views.

Observation on the Decalcified and Stained Preparations.

If a newly extracted sound tooth be submitted to be fixed and decalcified, and made into longitudinal or transverse sections of less than seven microns at least, stained more than six hours with Delafield's hæmatoxylene, mounted in balsam, and then examined with the microscope, we can observe the section as seen in Figs. 3 and 4.

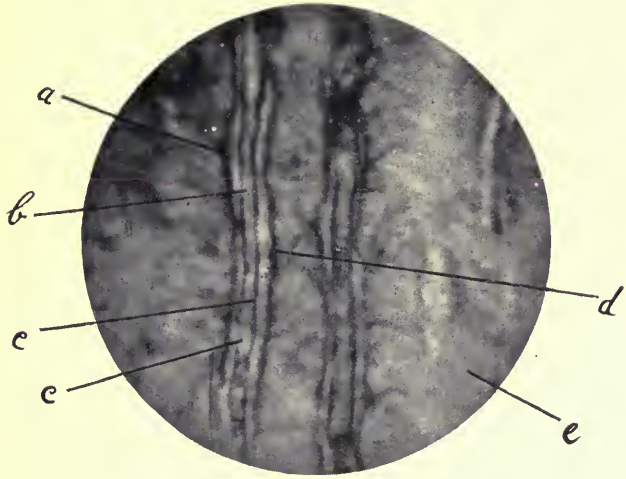

Fig. 3. Longitudinal section of dentin, Delafield's hæmatoxylene staining. Magnified 1800. (a) Transparent layer between dentinal fibril and tubule, (b) Dentinal fibril, (c) Contour layer of dentinal fibril, (d) Wall of dentinal tubule, (c) Ground substance.

As you see, the dentinal fibrils possess contour layers which stain deeply with hæmatoxylene, as Römer demonstrated; therefore, we can observe rings in transverse section (Fig. 4, C) and in the longitudinal sections two paralleled lines (Fig. 3, C and C). Sometimes, the fibrils, as in Fig. 5, stain so deeply that they look like solid substance, as Fleischman considered. This fact seems to the writer to show that he was misled by the phenomenon that the whole superficial surface of the fibrils, which took too much pigment itself in some cases. This fact is confirmed by Fig. 6.

Whenever the writer makes sections embedded with celloidin of the pulps extracted from the pulp cavities and examines the transversely or obliquely cut processes of the odontoblasts in the sections, he always observes that they have an appearance just like rings. Furthermore, the writer observes in the preparations stained with hæmatoxylene of odontoblasts taken from the interior wall of pulp cavities, layers somewhat like the membrane of cells which develop into the periphery of the dentinal fibrils. These facts convince us that the view that the

fibrils are homogeneous (which was maintained by Fleischmann and many others) is not satisfactory. But the writer does not coincide with Römer at all in the opinion that the dentinal tubules are tubular and admit lymph. If the contour layers of the dentinal fibrils be the transi-

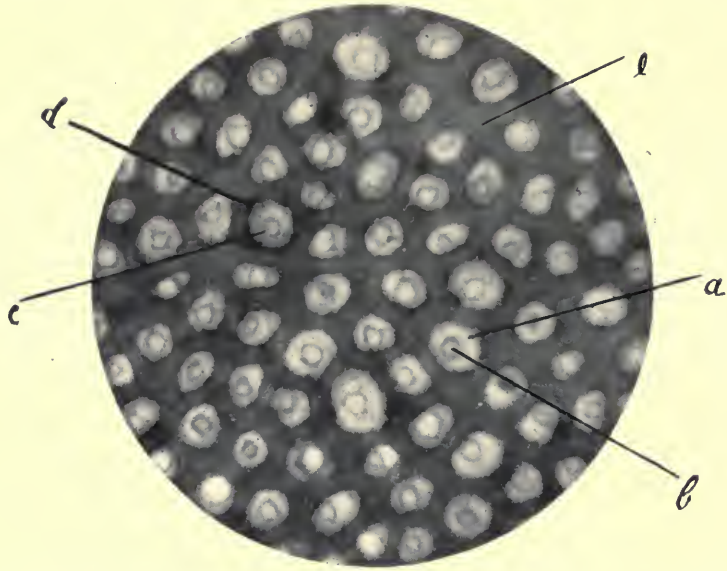

Fig. 4. Transverse section of dentin. Delafield's hæmatoxylene and eosin staining. Magnified 1800.
(a) Transparent layer between dentinal fibril and tubule, (b) Dentinal fibril, (c) Contour layer of dentinal fibril, (d) Wall of dentinal tubule, (e) Ground substance.

tive part of the membrane of the odontoblasts, as he believed, the contents of them (Figs. 3 and 4 b) ought not to be lymph but rather the protoplasm of the cells.

The part "d" in Figs. 3 and 4 is a layer termed the "Dentinal Sheath" by Fleischmann and Kantorowicz, and explained as the bordering layer to the ground substance by Walkhoff. Römer, though he does not make any explanation of this in his work, will not perhaps deny the existence of the layer in question to-day. For when the writer was spending some time in this research in Römer's laboratory, he could get his acknowledgement by showing him the preparations deeply stained with hæmatoxylene which demonstrate vividly the existence of the layer.

On examining this layer in well stained preparations (Figs. 5 and 6), we may find many tubular branches given off through the ground substance from the outer portion of the layer which anastomose with those of neighboring tubules. At the same time, we may also observe,

as in Figs. 7, 8, 9, that the dentinal fibrils give off fine branches from their outer border and permeate the small branches above alluded to. If the view that the dentinal fibrils lie in the dentinal tubules is right (the layer in question, is similar to the dentinal fibril in shape and in the way

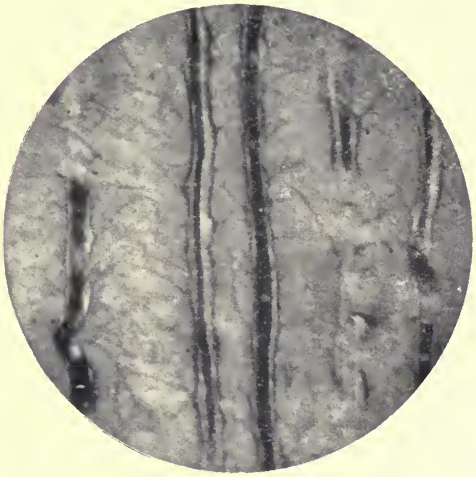

Fig. 5. Longitudinal section of dentin, Delafield's hæmatoxylene staining. Magnified 1050.

of spreading forth in branches) no objection should be raised to the conclusion that it is the wall of the dentinal tubule, nor to its nomenclature as the "Dentinal Tubules." In this respect, the writer coincides with Fleischmann and Kantorowicz.

But we still have an important question to clear up; whether this layer is composed of the so-called "Dentinal Sheaths" or "Neumann's Sheaths," strongly resistant to chemical agents, as has been believed by many scholars since Neumann's demonstration. The writer will treat this problem in another chapter, and here the writer will describe the comparatively transparent layers which intervene between the walls of the dentinal tubules and the dentinal fibrils.

The transparent layer which is seen in Figs. 3 and 4, is looked upon by Fleischmann as the interstices due to the contraction of the dentinal fibrils as already mentioned; and by Walkhoff it is described to be the dentinal sheaths composed of peculiar substance and he said that they may be readily isolated by chemical agents. And Römer explained it as a slightly calcified ground substance. In deeply stained sections, the layers present sometimes a pink tint by eosin or acid-fuchsin and very often a light color and form granular precipitate (Fig. 4). From this

fact, we may conclude that the layer in question is not a simple interstice.

On the other hand, however, we observe very often that there never are present any layers between the two, as the dentinal fibrils have posi-

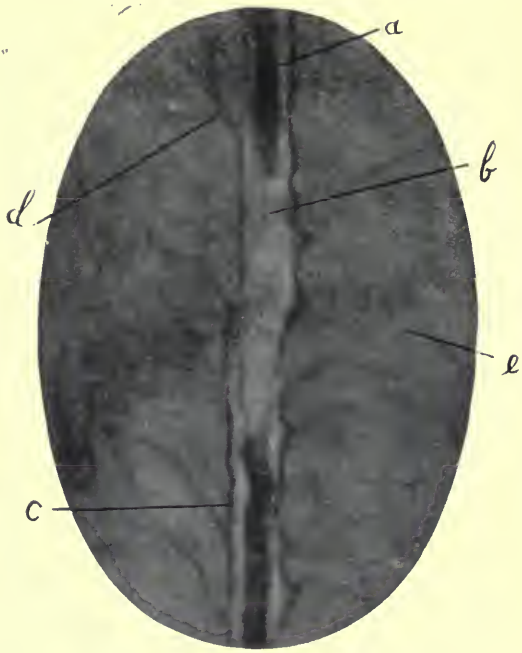

Fig. 6. Longitudinal section of dentin, Delafield's hæmatoxylene staining. Magnified 1800. (a) Deeply stained portion of dentinal fibril, (b) Slightly stained portion of dentinal fibril, (c) Deeply stained wall of dentinal tubule, (d) Branch of dentinal tubule, (e) Ground substance.

tively filled up the tubules; and besides in other cases the dentinal fibril would fill up some part of the tubules and sometimes not. Consequently, the writer can not infer that the layer exists originally.

If the above mentioned fact is true, then we should have the following questions to clear up: how this layer has come about and why this layer is stained in some cases and not in others. To solve these problems, the writer wishes to present the results of his observation on the ground sections and study their relation to the decalcified sections.

Observation on the Ground Sections and their Relation to the Decalcified Sections.

When we make extremely thin longitudinal sections of dentin and examine them with a small diaphragm, we will find there are in the

ground substance fibrous-appearing material which runs longitudinally; and in the borderland of which we also observe white layers which refract light (Fig. 11). In the case of the transverse ground preparation, we can see, as in Fig. 12, that there are up-heaved thick contour layers

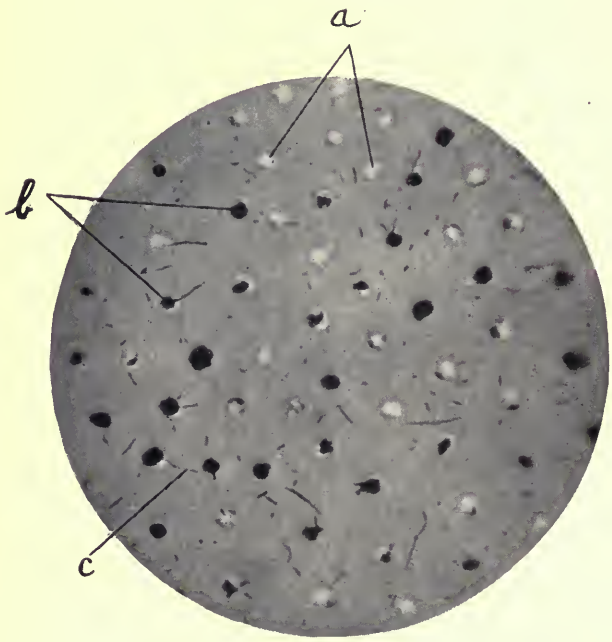

Fig. 7. Transverse ground section of dentin, impregnated with nitrate of silver and decalcified in ten per cent. solution of hydrochloric acid, and then stained with hæmatoxylene. The dentinal fibrils and their branches present a dark tint and the walls of dentinal tubules a purple color. Magnified 1050.
(a) The dentinal tubules with dentinal fibrils having fallen off, (b) The dentinal fibrils which present a dark tint as silver-salt precipitate, (c) The branch of dental fibril.

on the border of the transverse surface of the fibrous-appearing materials, and the layers refract light, just as in the case of the longitudinal sections. It is yet an undecidable problem whether the layer is structural or not, and whether it may be compared to the transparent layer which intervenes between the dentinal fibrils and the walls of the dentinal tubules as in the decalcified and stained preparations. The writer is at present of the opinion that the greater part of this layer is only a visual image, brought out by refraction of light, as Ebner, Fleischmann, and Walkhoff believed. If you examine minutely this layer, by handling the fine adjustment of the microscope, you will have an exact understanding of our opinion, with which you will possibly agree. It is desirable to

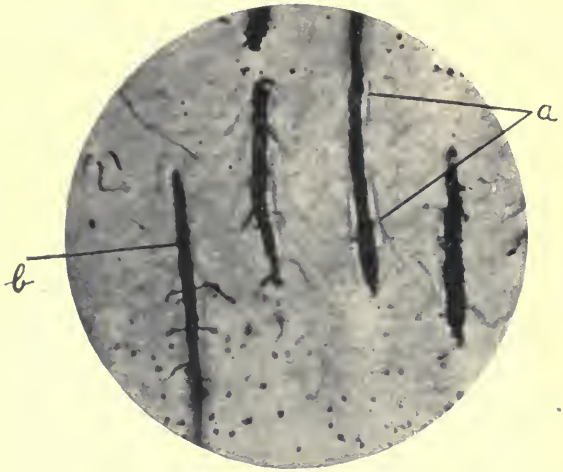

Fig. 8. Longitudinal ground section of dentin, impregnated with nitrate of silver and decalcified in hydrochloric acid, and then submitted to the double staining of hæmatoxylene. Magnified 1050.

(a) Wall of dentinal tubule which was stained with hæmatoxylene, (b) The dentinal fibril presents a dark tint due to the precipitation of silver-salt. Special attention is called to the branches distinctly given off from it.

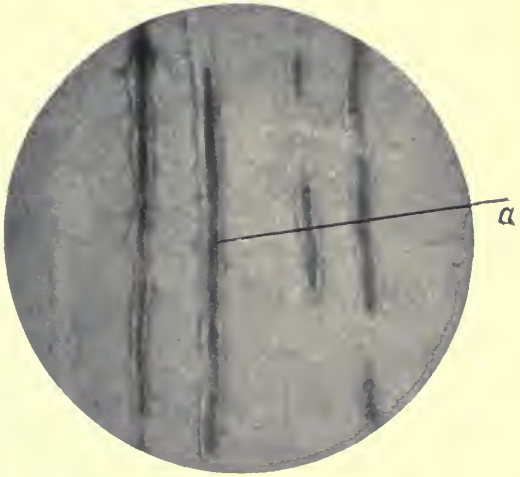

Fig. 9. Longitudinal section of dentin stained by Delafield's hæmatoxylene. Magnified 1050. (a) Dentinal fibril, along both sides of which branches are to be seen.

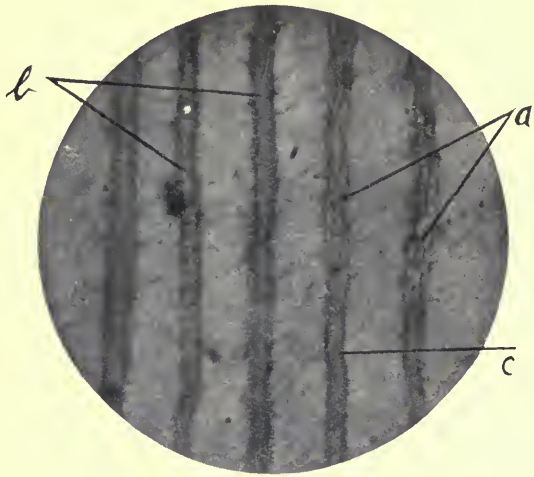

Fig. 10. Longitudinal section of dentin, hæmatoxylene staining. Magnified 1050.

(a) The portion where dentinal fibrils have not filled up the dentinal tubules, or the transparent layer which intervenes between the two, (b) The portion where it is supposed that the dentinal fibrils have filled up the tubules, so that there is demonstrated no transparent layer between the two, (c) The portion where the dentinal fibril has filled the tubule.

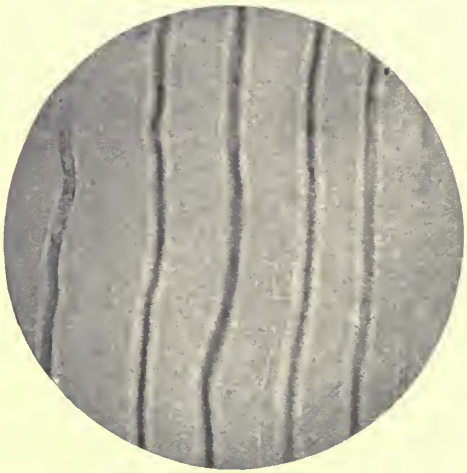

Fig. 11. Longitudinal ground section of dentin, not stained. Magnified 1050.

stain ground sections with hæmatoxylene as in the case of decalcified sections, and make a comparative study on both. Hæmatoxylene is apt, however, to precipitate on ground sections and fails always to attain the results of perfect pigmentation. Fuchsin does not have this defect

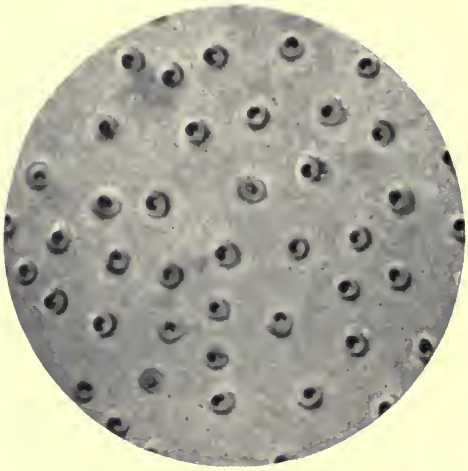

Fig. 12. Transverse ground section of dentin, fuchsin staining. Magnified 1050.

which hæmatoxylene possesses, because when the decalcified sections are allowed to stain with fuchsin, we find always that the result by the latter is quite as good as when we use hæmatoxylene and further we find another advantage in fuchsin of being also applicable to ground sections. When we stain the ground sections, the fibrillar substance will present a crimson tint, and branches which start from the outer portion of the substance may be distinctly perceived. In what relation will be the crimson fibrillar substance to the dentinal fibrils and tubules in the decalcified stained sections? In order to solve the question, the writer has made a preparation for this purpose by means of a specially designed method.

The writer ground down a fresh tooth to a section of about one or two mm. in thickness, and put it in a test tube in which Ziehl's carbol-fuchsin or concentrated fuchsin solution was charged (alcohol solution is also available) and warmed and stained it for one or two hours in a water bath. Whereupon again we rubbed down the sections on the grinder at both sides to render them extremely thin; during the time water was being poured continuously; and afterwards it was cleaned in water and dried by means of blotting paper. Then the section was

held with forceps and coated with paraffin on its half side, then dipped into five per cent. solution of nitric acid, so that the other half might be decalcified in it for five minutes. This decalcified section was cleaned in water, stained with hæmatoxylene or diluted fuchsin, and when the

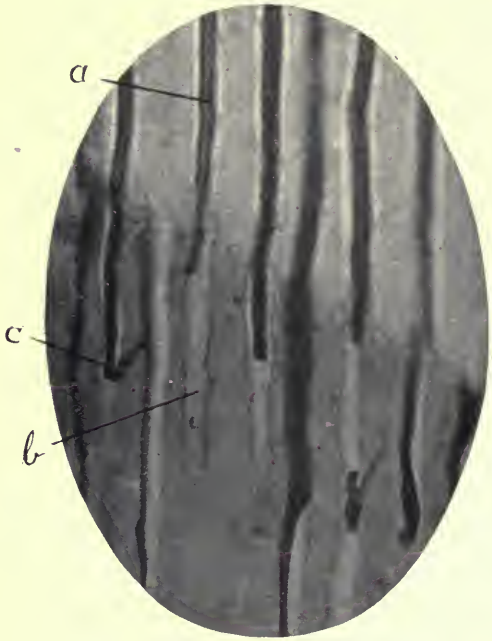

Fig. 13. Longitudinal ground section of dentin, fuchsin staining. Magnified 1050. The upper half shows the area unaffected by acid action. The lower half shows the area affected by acid action.
(a) Dentinal fibril, (b) The wall of dentinal tubule distinctly stained with fuchsin and dentinal fibril fallen out, (c) The dentinal fibril runs off from the tubule and describes curves.

dehydration in alcohol has comp'eted, paraffin was dissolved off by dipping and warming in xylol. The section was imbedded in balsam. By these means, we can obtain a specimen which would show clearly the close relation between the ground section and the decalcified one.

The 13-16 specimens have been made up by these methods; they show quite distinctly the difference between the two halves, namely, the portion affected by acid action, and that absolutely unaffected. From these specimens, the writer learned the following facts, i. e.:

1. The fibrillar-appearing substance in the ground section is same as the dentinal fibrils in decalcified sections.
2. The walls of the dentinal tubules which are in obscurity in the

ground sections are stained and present quite distinctly in the decalcified preparations.

3. On the action of acid, a distinctly transparent layer makes its appearance in the surrounding part of fibrils.

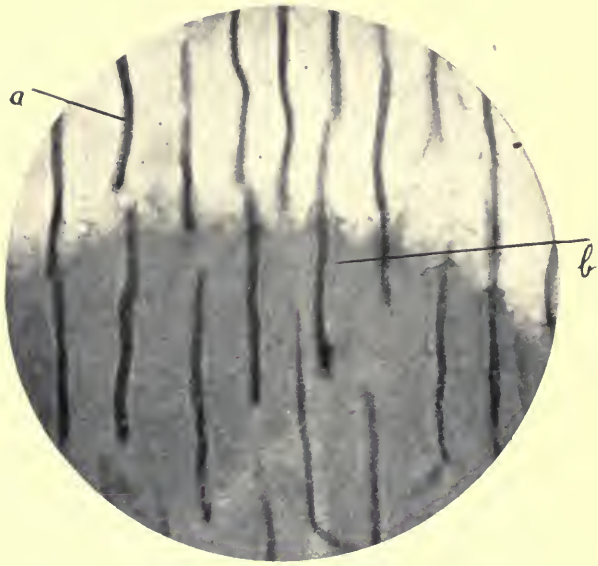

Fig. 14. Longitudinal ground section of dentin, fuchsin staining. Magnified 1050. The upper half shows the area unaffected by acid action. The lower half shows decalcified portion. (a) Dentinal fibril, (b) Dentinal tubule contains dentinal fibril. The wall stains clearly with fuchsin, and besides the branches are perceptible.

4. The dentinal fibril shows little change in size in either the ground sections or decalcified ones.
5. The ground substance, in the ground sections, does not stain with fuchsin, but stains crimson easily with the same after treatment with the acid, while the pigmentation of dentinal fibrils is unchanged in either case.
6. When the transparent layer around the dentinal fibrils, which is considered as interspace of dentinal tubules by Fleischmann, is caused by the action of acid, the dentinal fibrils become very often detached freely from the dentinal tubules, and the shape and the condition of processes become irregular. Furthermore, as the dentinal fibrils fall off, the hollowness of the tubules is caused (Figs. 16C and 13B).
7. The up-heaved contour layers in the ground sections which the

writer has explained as a visual image for the most part, seem to be identical with the transparent layers which present surrounding the dentinal fibrils in the decalcified sections (Fig. 16). The transparent layer becomes, however, on the action of

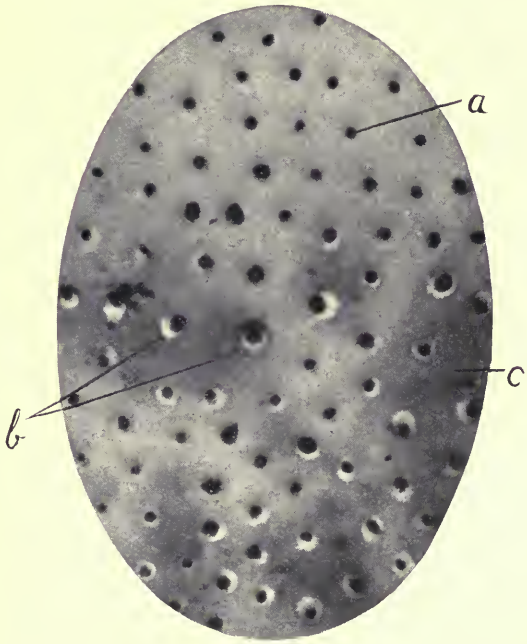

Fig. 15. Transverse ground section of dentin, fuchsin staining. Magnified 1050. The upper half shows the area unaffected by acid action. The lower half shows the stained area in the ground substance affected by the action of acid.
(a) Dentinal fibril, (b) Dentinal tubules contain dentinal fibrils, (c) Ground substance crimson stained by fuchsin.

acid, irregular and more enlarged rather than resembling upheaved contour layer (Fig. 17).

8. According to Fleischmann and many other scholars, the transparent layer (Fig. 1, Part II) which is demonstrated between the dentinal fibrils and the so-called dentinal sheaths, is the interspace which has been treated due to the contraction of the dentinal fibrils. But this assumption is utterly wrong, because the dentinal fibrils never contract in reality, but the so-called walls of the dentinal tubules become extended by the action of acid to form this layer in question.
9. The phenomenon that the transparent layers between the dentinal

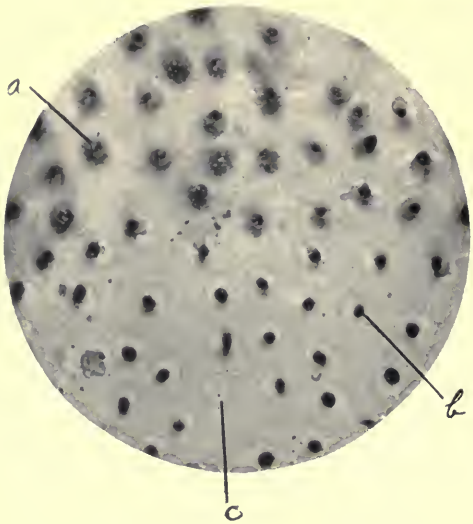

Fig. 16. Transverse ground section of dentin, fuchsin staining. Magnified 1050. The upper half shows the area unaffected by acid action. The lower half shows the area affected by acid action.

(a) Dentinal fibril surrounded by the contour layer which appears upheaved, (b) Dentinal fibril, around which dentinal tubule is seen, (c) Dentinal tubule, from which dentinal fibril has fallen off.

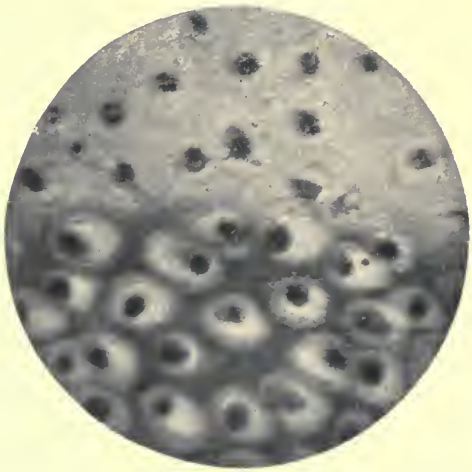

Fig. 17. Transverse ground section of dentin, fuchsin staining. Magnified 1800. The upper half is not affected by the action of acid. The lower half has sustained acid action, and the ground substance is stained crimson.

fibrils and the walls of the dentinal tubules in the sections are frequently stained and present a granular appearance is supposed to be caused by the fact that a portion of the organic matter remains behind and fine branches of dentinal fibrils lie there.

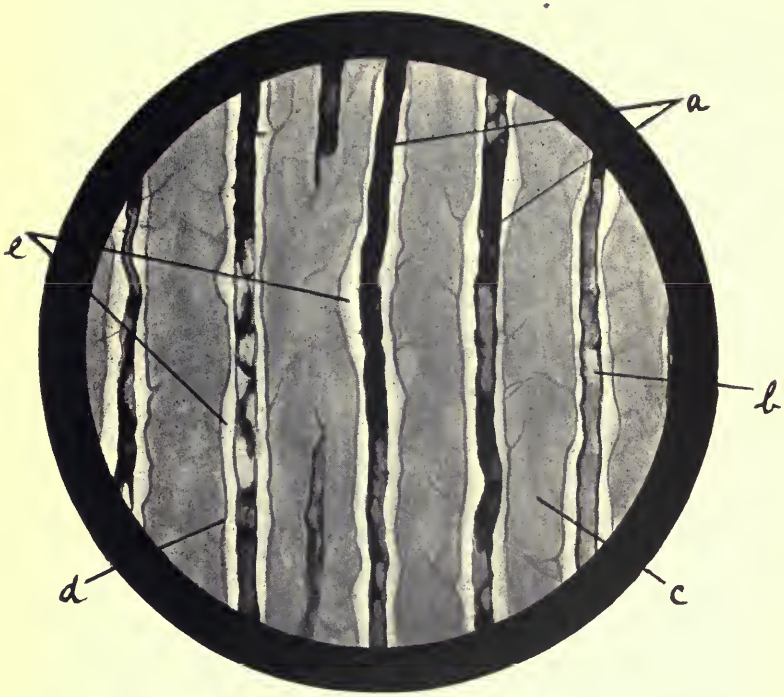

Fig. 18. Longitudinal ground section of dentin, injected with China ink, decalcified in nitric acid, imbedded with celloidin, hæmatoxylene staining. Magnified ab. 1500.
(a) Area presents a black tint due to the deposit of China ink surrounding the dentinal fibril, (b) Area surrounding the dentinal fibril; China ink hardly adheres, (c) Ground substance, (d) Wall of the dentinal tubule, stained with hæmatoxylene, (e) An interstice newly formed by the action of acid.

Observation on the Injection Preparation of Dentinal.

The writer observed from the joint preparation of ground and decalcified sections the fact that the dentinal tubules would expand extremely by the action of acid. And then what will be the real character of the dentinal tubule itself? In other words, will it be true, as Römer believes, that nutritious fluids are conveyed only by the medium of the dentinal fibrils? Otherwise, are there any interstices between dentinal fibrils and tubules through which the fluid may be transferred? In order to give a clear answer to these problems, the writer chose the method of ink

injection into dentin under the following process, by which he has been able to prepare many interesting specimens.

The writer took first a freshly extracted tooth and exposed a part of dentin by removing the enamel of the crown, and then cut off a portion of the root; widened the root canal with a bur, extracted the pulp, and afterward washed the pulp cavity thoroughly; dried it, and poured in filtered china ink which had been mixed with a little quantity of gelatine, and

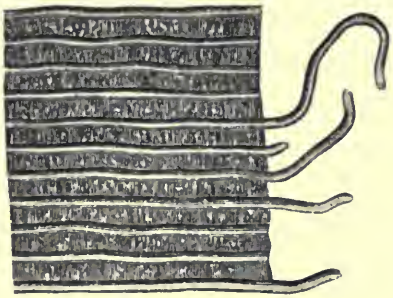

Fig. 19. After John Tomes. A section from the crown of the tooth of an adult, made in a plane with the direction of the dentinal tubes, and afterwards decalcified and then torn in a line transverse to the direction of the tubes.
(*Tomes's Dental Surgery*, 1852, page 328.)

afterwards fixed the whole tooth into thick walled stout rubber tubing, which again was covered with a metal tubing. This rubber tubing, is connected with an air pump which exerted a pressure of about ten atmospheres. If we examine the tooth section which was ground after the completion of the china ink injection, we observe the principal path of the china ink is traced as it has run along the exterior portion of dentinal fibrils, around which it adheres unevenly in deposition with granular appearance. In the sufficiently ink-injected portion, we would see simply black fibrillar substance clustered together. But if we take further procedure so as to decalcify the ground sections in the acid, and stain them with hæmatoxylene or fuchsin (as in Fig. 18) we can observe fresh appearance of a transparent layer around the fibrillar substance, and again near the ground substance we see a layer deeply stained with hæmatoxylene and fuchsin. These appearances are identical with those of decalcified and stained parts; namely, the black-stained part is the dentinal fibrils around which is deposited the china ink. The stained layer close by the ground substance is believed to be the walls of dentinal tubules. And if the space between the dentinal fibrils and tubules be the originally existing interspace, we should observe this part being filled up with china ink at least. But the fact is completely opposite to this supposition. So

that we should conclude that the transparent layer has been created merely by the action of acid.

Observation on the Mechanically Isolated Preparations.

If a fresh and sound tooth be allowed to decalcify in an acid like nitric acid; cut in longitudinal sections, and torn with two needles at right

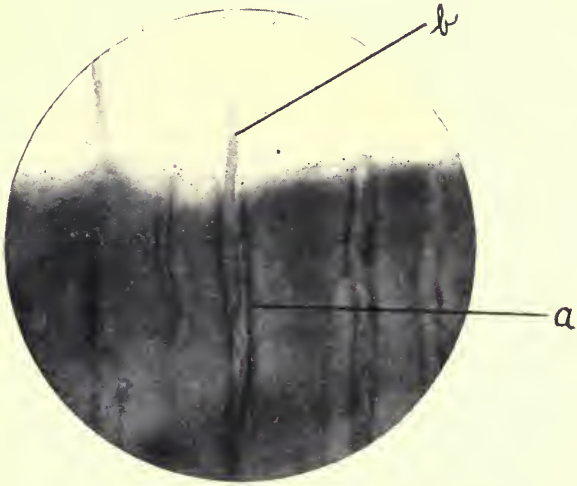

Fig. 20. Longitudinal section of dentin. Magnified 1050.
(a) Deeply stained wall of dentinal tubule by hæmatoxylene, (b) Dentinal fibril projecting from dentinal tubule.

angles to the direction of the dentinal tubules, one would observe many projecting pieces of fibrillar substance at the fractured edge. This fact was discovered first by Tomes, in 1892, and he explained that they are dentinal fibrils, or processes of odontoblasts (Fig. 19). But Walkhoff (10) Boll (11) and Fleischmann (12) declared that the fibrillar substance which is isolated by Tomes's mechanical means is not the dentinal fibrils, but the dentinal sheath which appears tubular, and further decided that the fibrillar substance projecting again from the isolated sheath is the real dentinal fibril, or Tomes' fibril.

As far as the writer's experience has gone, it is quite difficult to ascertain the character of the fibrillar substance projecting on the torn

(10). Walkhoff, Das sensible Dentin und seine Behandlung, 1899.

(11). Boll, Formation of the Dentine, Dental Cosmos, No. 4, 1870.

(12). Fleischmann, Histologie und Histogenie. Ergebnisse der gesamten Zahnheilkunde, Heft 1, 1910.

edge, merely by tearing unstained sections on object glasses, whether they are dentinal fibrils or dentinal sheaths which contain the former, because the proper differentiation between dentinal fibrils and tubules is impossible in the case of unstained sections. For this reason, the

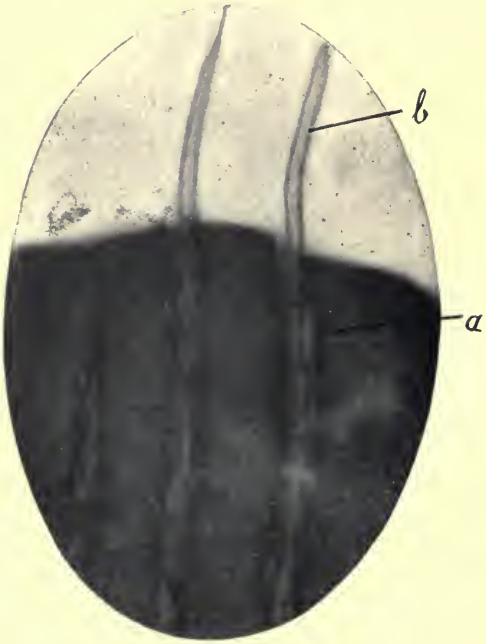

Fig. 21. Longitudinal section of dentin. Magnified 1050.
(a) So-called Neumann's sheath deeply stained by hæmatoxylene, (b) Dentinal fibril projecting out of dentinal tubule.

writer prepared stained sections to distinctly show the difference between dentinal fibrils and tubules, and followed the below mentioned methods to put an end to this controversy.

The writer made from a fresh and sound tooth as fine a section as possible (eight microns at least), stained it over twelve hours with Delafield's hæmatoxylene, dehydrated by alcohol, gave transparency by means of carbolic xylol, set on an object glass, tore with two needles at right angles to the direction of the dentinal tubules, and then imbedded in balsam. On examining it with the microscope, he could ascertain that. as can be seen Figs. 20 and 21, both the walls of the dentinal tubules which stained more deeply than the ground substance or "dentinal sheaths" after Fleischmann, and the transparent layer intervening between the dentinal fibrils and tubules, or the portion considered as "dentinal

sheaths" by Walkhoff, are not to be isolated alike; and that the fibrillar substance projecting from the fractured edge is nothing but the dentinal fibrils, the contents of the dentinal tubules. By repeating this method on a number of sections, the writer noticed the fact that it is a very fre-

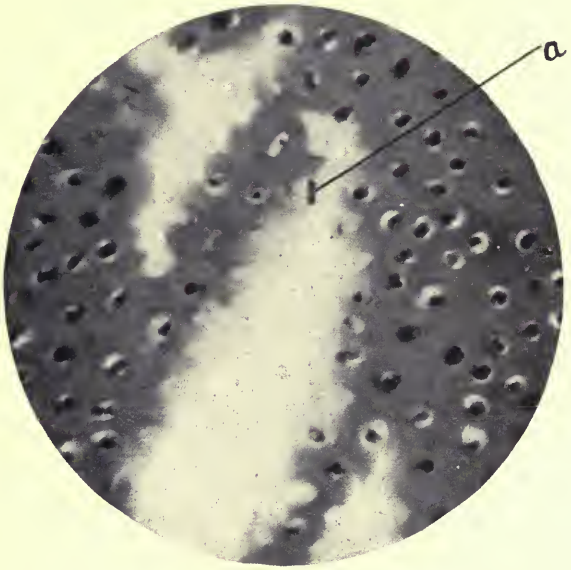

Fig. 22. Transverse ground section of dentin, decalcified in ten per cent. solution of nitric acid, and afterwards stained with fuchsin and then torn on the object glass. Magnified 1050. (a) Dentinal fibril separated at the fractured edge.

quent occurrence in case the sections are thicker than eight-ten microns, that the difference between the so-called walls of dentinal tubules and the dentinal fibrils is not at all differentiated, and consequently to ascertain to which of them the projecting fibrillar substance belongs is quite impossible. Furthermore, the writer learned that it is not an unusual case that as the dentinal fibrils present an appearance of tubules on hurried examination, the projecting fibrillar substance is mistaken for the tubules through indiscreet judgment. But in the case of thin stained sections, there hardly occurs any misjudgment, for the difference between them is quite distinct.

And now it should be added that the writer met a few times in his research, the dentinal sheaths which are accompanied by a portion of ground substance projecting only a little from the torn edge. In that case, they have not as perfect a structure as dentinal tubules but should be explained as merely a piece of the outer border of so-called dentinal

Fig. 23. Odontoblasts and their processes separated from the interior surface of the pulp cavity, fuchsin staining. Magnified 1050.

sheaths deeply stained with hæmatoxylene. Wherefore, the writer claims that the view which has been maintained by many histologists since Neumann, i. e., that which is isolated by mechanical means is the dentinal tubules or dentinal sheaths is utterly wrong. In other words, the writer insists that the fibrillar substance easily isolated by tearing of the decalcified section is only the dentinal fibril, or the content of dentinal tubules. And the transparent layer which Walkhoff insisted to be the dentinal sheath, is positively caused by the expansion of dentinal tubules with the action of acid. So that it is clear that it is utterly impossible to isolate this layer by any mechanical means.

Further study so as to obtain accuracy of this fact was tried by other various means as follows:

At first very thin sections of dentin both oblique and transverse, were made, and stained with hæmatoxylene or fuchsin, rendered trans-

Fig. 24. Dentin specimen isolated and stained with fuchsin. Magnified 580; compensation ocular 4, apochromatic objective, dry system 4 m.m.

parent in carbolic xylol, so that they might be examined as to the difference between dentinal fibrils or tubules on microscopic examination; and then they were torn by needles on the object glass.

After this, the preliminary process is completed, it is clearly observed that the so-called dentinal sheaths are in every case, just as in the case of the longitudinal sections, fractured on the torn edge, and then never is seen any example of isolated dentinal tubule, tubular or ring-appearing either, but we see only the isolation of dentinal fibrils, the contents of dentinal tubules. Another research which the writer carried on for the same purpose is thus: The writer took a fresh tooth, rubbed it down on a grinder so as to make an extremely thin transverse section of dentin without any preliminary treatment, and decalcified in five-ten per cent. solution of nitric acid or hydrochloric acid for two or three minutes, and then stained it with hæmatoxylene or fuchsin, and examined it after tearing on the object glass. Again through this method the result was just the same, or the dentinal fibrils were isolated alone (Fig. 22).

From the result above mentioned it is a demonstrated fact that the

substance which has a specially strong susceptibility to such coloring matters as hæmatoxylene or fuchsin in the decalcified sections, i. e., so-called dentinal sheaths or sheaths of Neumann, are quite weak in resistance to mechanical means, having no characteristic difference to com-

Fig. 25. Isolated preparation of dentin, same as above. Fuchsin staining. Magnified 1050.

mon ground substance; and it is easily destroyed and never to be isolated. Instead of this, the dentinal fibrils, or contents of dentinal tubules, have a remarkably elastic nature and is resistant to mechanical action, so that they are easily extracted or isolated out of the dentinal tubules. In reality, when we practice the extraction of a pulp out of the interior surface of the pulp cavity, it is quite frequently the case that many long dentinal fibrils, or the processes of odontoblasts, are together isolated from the dentinal tubules, as it is commonly known. Then by similar way of reasoning, it seems quite fair to believe that the fibrillar substance obtained by tearing the section of dentin is identical with the dentinal fibrils.

Observation on Chemically Isolated Preparations.

In 1852, Kölliker discovered the possibility of isolation of the fibrillar substance by treating the dentin with the concentrated acid or alkali. At that time he believed it to be the dentinal tubule and explained that it contains a certain quantity of fluid within. But in 1856, Tomes demonstrated the fibrillar substances, which he had isolated by mechanical means to be solid dentinal fibrils. Before this demonstration of Tomes, Kölliker had believed that that which he isolated by acid or

alkali is the dentinal tubule. But with Tomes's view tested he abandoned his former belief and acknowledged that what he had demonstrated is identical with Tomes's fibrils. In 1863, Neumann for the first time cleared up the difference between dentinal fibrils and tubules, and in-

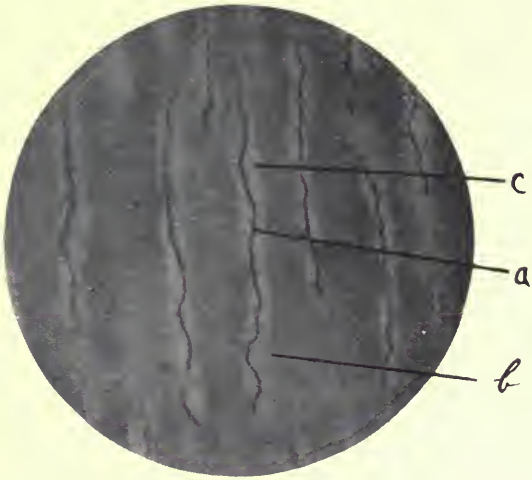

Fig. 26. Ground section of dentin, slightly affected by the action of fifty per cent. solution of hydrochloric acid. Fuchsin staining. Magnified 1050.
(a) Wavy dentinal tubule, (b) Wall of dentinal tubule, (c) Expanded dentinal tubule.

troduced an opinion that the dentinal tubules have walls of peculiar resistance against acid and alkali, which he termed "sheaths," or the things called by the name of the "Neumann's sheaths" by histologists in general at present. This view of Neumann has met the acceptance of almost all histologists. Since then his opinion, i. e., those which are isolated are dentinal sheaths, has been generally believed as the authorized opinion up to the present day. But there are variously different views in regard of the position of the dentinal sheaths, as to be seen in Fig. 1, among such histologists as Römer, Walkhoff, Fleischmann; consequently in reference to the isolated substance, there arises a variety of opinions among these histologists.

Römer believed that the dentinal fibrils, dentinal tubules, or processes of the odontoblasts (Fig. 1, part 1) may be isolated. Walkhoff held that the portion II in Fig. 1 is the dentinal sheath which can be isolated. Fleischmann calls the portion III in Fig. 1 the dentinal sheaths (that is, the walls of the dentinal tubules according to the writer) and claims this layer has a peculiar resistance to acids and alkalis. Fleischmann concurs with Neumann in this respect as the writer has already described.

Now, as may be seen in Figs. 24 and 25, we may easily isolate the fibrillar substance, if we proceed as follows: prepare a ground section of dentin, set it on an object glass, and then treat with concentrated acid (the writer employs exclusively fifty per cent. solution of hydrochloric

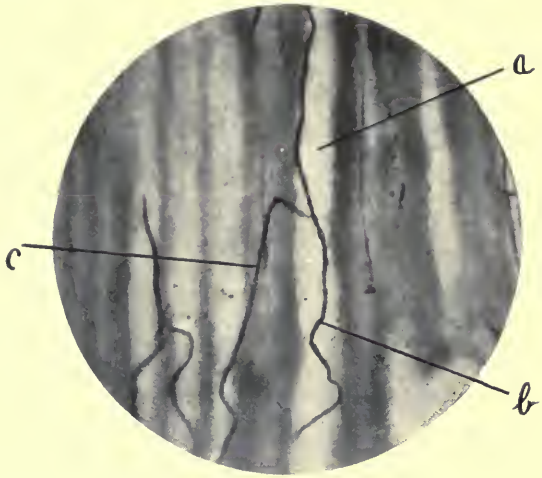

Fig. 27. Ground section of dentin affected for a long time by the action of fifty per cent. solution of hydrochloric acid. Fuchsin staining. Magnified 1050.

(a) Remarkably expanded dentinal tubule, (b) Serpentine dentinal fibril, (c) Dentinal fibril extending from dentinal tubule.

acid) cover with a cover glass, and afterward warm on the flame of alcohol lamp until it steams. But in the substance obtained by this method it is still difficult to discern whether it is the dentinal tubule or the dentinal fibril. Whereupon, the writer prepared many ground sections to have a clearer judgment by treating these preparations with the strong action of the concentrated acid for varying lengths of time for each of these sections, stained with fuchsin, and then watched from what part of the section the isolation would commence. And when the fuchsin staining was completed, the dentinal fibrils were observed presenting deep crimson, the ground substance light crimson, the walls of the dentinal tubules deep crimson, and the interspace between the dentinal fibrils and the walls of the dentinal tubules became transparent. At the commencement of the isolation, it is observed the dentinal tubules enlarge extremely and the dentinal fibrils present a wavy and spiral appearance in the dentinal tubules (Fig. 26). Furthermore, on examining the abovementioned sections by treating them with the action of the acid for a longer time than in the former case, we observed the following phenom-

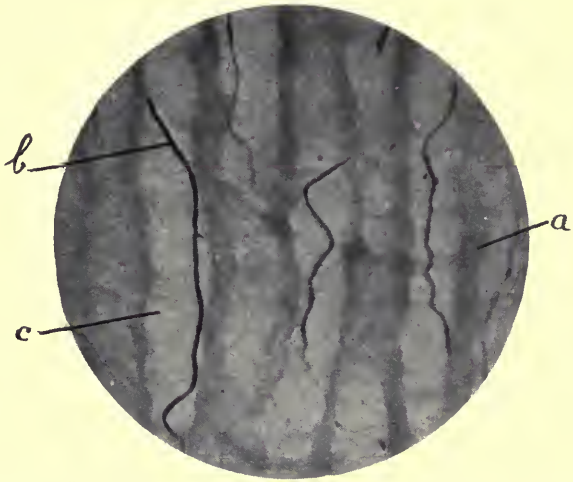

Fig. 28. Dentin affected for longer time by the action of fifty per cent. solution of hydrochloric acid. Fuchsin staining. Magnified 1050.

(a) Ground substance, (b) Dentinal fibril, (c) Expanded dentinal tubule.

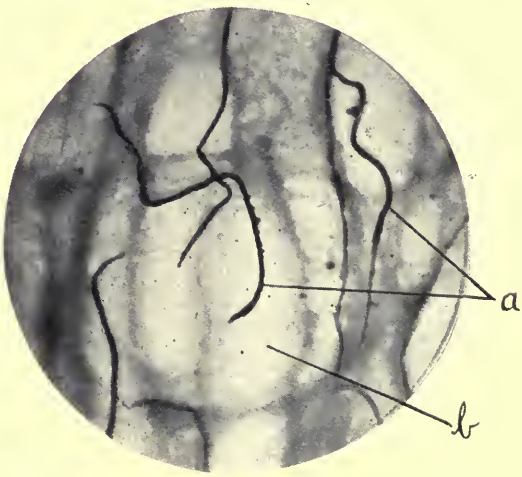

Fig. 29. Dentin, affected for a considerable time by the action of fifty per cent. solution of hydrochloric acid. Fuchsin staining. Magnified 1050.

(a) Dentinal fibrils remain unaffected, (b) Traces greatly expanded dentinal tubule.

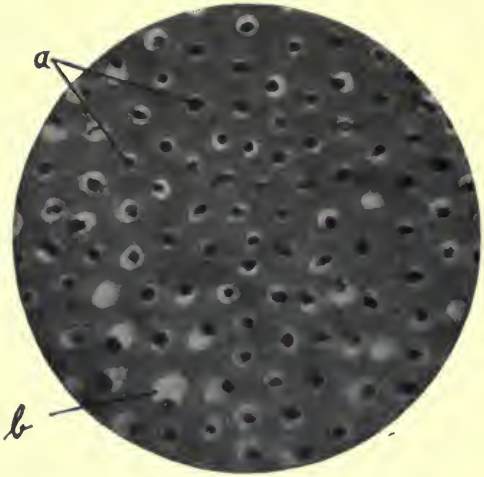

Fig. 30. Transverse ground section of dentin, affected for a short time by the action of fifty per cent. solution of hydrochloric acid and afterwards stained by fuchsin. Magnified 1050.

(a) Dentinal fibrils and tubules, great expansion of latter are not noticed, (b) Slightly expanded dentinal tubule; fibril lies more closely to one side.

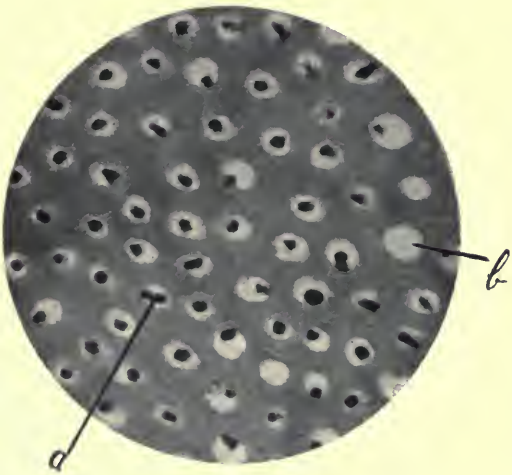

Fig. 31. Transverse ground section of dentin, affected by the action of fifty per cent. solution of hydrochloric acid. Fuchsin staining. Magnified 1050.

(a) Dentinal fibril lies more closely to one side in the dentinal tubule, (b) Dentinal tubule expanded and dentinal fibril broken off.

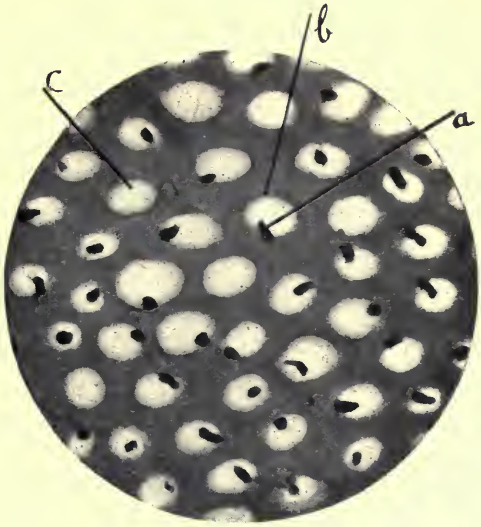

Fig. 32. Preparation and staining same as in Fig. 31. Magnified 1050. The dentinal tubules expand remarkably as a whole.

(a) The dentinal fibril is about to withdraw from the dentinal tubule, (b) The wall of dentinal tubule which still has affinity to coloring matters, (c) The dentinal tubule, from which the dentinal fibril withdraws.

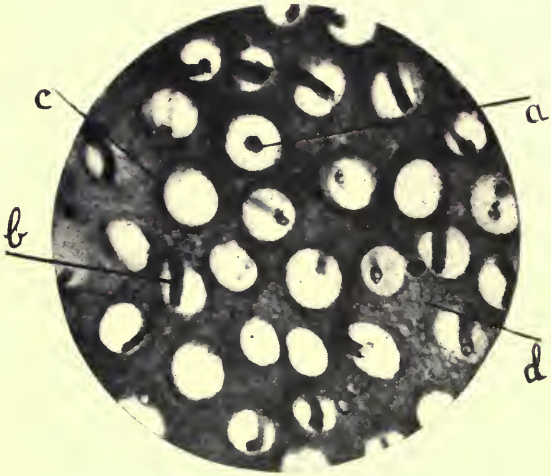

Fig. 33. Preparation and staining as before. Dentinal tubules expand remarkably and the ground substance differs in susceptibility to staining.

(a) The dentinal fibril lies in the centre of the expanded dentinal tubule, (b) The dentinal fibril declined to one side, (c) The wall which still has susceptibility to staining, (d) The ground substance which is not uniform in susceptibility to staining, and is about to be dissolved by the acid.

ena, as may be seen in Fig. 27, that the dentinal tubules (a) became very much enlarged, the dentinal fibrils (b) lay in serpentine appearance in the dentinal tubules, and even a part of the fibril comes out of the tubule; the ground substance (c) was about to be dissolved by the

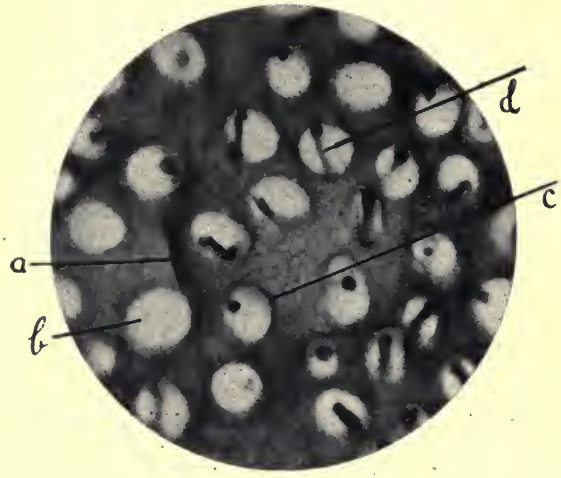

Fig. 34. Preparation and staining as before. Magnified 1050.

(a) Dentinal fibril outside the tubule, (b) Dentinal tubule from which the fibril withdrew, (c) The wall of a dentinal tubule has still susceptibility to staining, (d) A dentinal fibril which lies obliquely inside the expanded tubule.

action of acid, and at the same time stain with fuchsin not uniformly. The walls of dentinal tubules (the portion called Neumann's sheaths) are to be seen distinctly as they are more deeply stained by the pigment, but they seem to be about destroyed due to the action of the acid. Inside the expanded dentinal tubules, there are more or less fine filamentous matter, which is understood to be the ground substances in superficial layer or deep layer which are in the early stage of dissolution. Fig. 28 shows the further change of dentinal tubules and ground substance, and the fact that the so-called dentinal sheaths are easily reduced by the action of the acid, similarly as the dissolution of the ground substance. In Fig. 29, it is shown that both dentinal tubules and ground substance have been almost entirely destroyed, and that serpentine dentinal fibrils remain alone there deeply stained crimson by fuchsin.

By summing up the result of research already alluded to it may be clearly demonstrated that the fibrillar materials or remnants of dentin which were brought about when submitted to the action of acid or alkali, are never so-called dentinal sheaths, the walls of dentinal tubules,

but dentinal fibrils. In other words, the writer insists that the view accepted ordinarily by many histologists since Neumann, viz., the "dentinal tubules possess sheaths of strong resistance against chemical reagents," is all misconception, and Römer's opinion is quite correct in this respect.

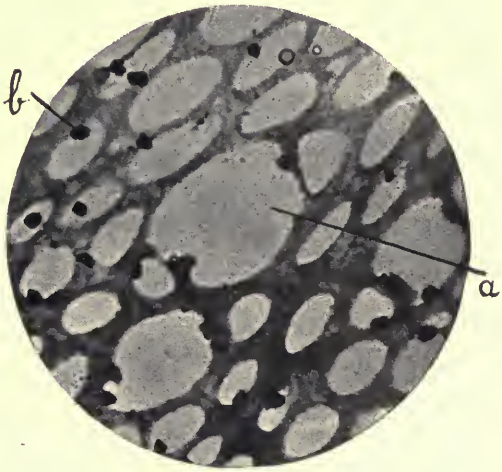

Fig. 35. Preparation and staining as before. This shows considerably advanced process of the acid. The dentinal tubules expand remarkably, which caused the diminution of ground substance between each tubule, and lack of uniformity in staining.

(a) The dentinal tubule expanded extremely and fused with a neighboring one, (b) Dentinal fibril.

In order to ascertain this fact furthermore, the writer followed a method as follows: at first a thin transverse ground section of dentin is prepared, and examined on the process of its isolation by the action of the strong acid. On the examination, as may be seen in Figs. 30-35, it is noticed again that the dentinal fibrils remained without any change at all, while the walls of the dentinal tubules expand little by little with the gradual change of the ground substance, and at last broke up utterly. As in Fig. 30a, the dentinal fibrils remain as small spots at the early stage, but with the gradual advance of acid action, they change their situations, some taking oblique or horizontal positions, and some remain detached far from the tubules (Fig. 34). In the case of isolation on the transverse ground sections, the result is the same as that of the longitudinal sections.

Conclusion.

The writer recapitulates here the result of his research:

1. Dentin is composed of the ground substance, similar to that of

bone, numerous dentinal tubules, which contain dentinal fibrils, permeating the ground substance.

2. The dentinal fibril is a process of the odontoblast, and presents apparently a form of tubing as it possesses a contour layer which stains with hæmatoxylene and basic colors. It is composed of protoplasm. The contour layer is believed to be the portion of protoplasm thickly condensed.
3. The dentinal fibrils have not a tendency of contraction to the action of any reagents at the time of preparation, but rather of more or less enlargement by the action of acid.
4. The dentinal tubules possess walls which have a characteristic of being stained by the basic colors. The walls are the same in histological nature with the common ground substance.
5. There exists a peculiar interstice between the dentinal fibrils and the walls of dentinal tubules through which fluid circulates. The interstice appears much larger in the decalcified condition. This is because the dentinal tubules are apt to be enlarged with the contraction of ground substance by the action of acid.
6. The fibrillar substance isolated by mechanical or chemical means is not the so-called dentinal sheaths, but the dentinal fibrils.
7. The walls of dentinal tubules possess no peculiar resistance as common ground substance against acid or alkali, so that it is improper to describe it with the name "sheaths."

The writer feels very grateful toward Prof. Dr. Oskar Römer, who assisted him when he was in Strasburg, in 1914, in furthering his research by showing the writer important specimens and giving very suggestive advice.

Papers Presented in Section II.

Etiology, Radiography, Pathology and Bacteriology.

Blood Findings in 162 Consecutive Cases of Chronic Oral Infection Associated with Teeth.

By Wm. H. G. Logan, Chicago, Ill.

Since most persons over forty years of age having natural teeth are believed to be afflicted with local areas of chronic oral infection, involving either the periapical or gingival pericemental and alveolar structures, and because we have scientific evidence of such a conclusive nature that pronounced systemic effects may result from peridental focal infections presented to the profession by Hunter in 1900, Kenneth Goadby in 1911, Billings, Davis, Nicol, Rosenow and Liebman in 1912 and Hartzell in 1914; and because it is the belief of a vast number of close observers that most of such patients remain free from disease that can be traced to oral focal infections, to the end that they are inclined to wait until the patient shows pronounced secondary infections before demanding the eradication of these foci; yet, because of the pathologic dictum, that in the presence of lowered resistance secondary involvements are most likely to occur from chronic infections, it has become essential to ascertain the usual blood findings in consecutive cases of oral sepsis to determine whether valuable information could be collected, which would be of benefit in reaching a decision that a chronic oral infection, though apparently producing no secondary effects, may in reality be sufficiently active to produce characteristic blood changes, which would be of diagnostic aid in deciding in favor of treating the infected foci with retention of the teeth, or demanding immediate extraction and possibly curettement of the area.

Before discussing the case records, I desire to call attention to the fact that they are all of patients presenting at my office; therefore, these reports should not be compared with those secured from patients confined to the hospital from ill health.

I herewith report on the blood findings* in 162 consecutive cases of chronic oral infection associated with teeth, of which 110 are advanced pyorrhea cases where the clinical evidence of pus was present, and in ninety-six per cent. of the cases some teeth had been lost or were so

*These examinations were never taken for some hours after the patient had partaken of a hearty meal.

seriously involved with the disease that extraction was demanded. The remaining fifty-two cases are of patients having chronic periapical infection without evacuating sinuses; however, eighteen cases had pyorrhea co-existing. For the convenience of study, I have divided them into the following six groups:

1. Pyorrhea cases with fair to normal blood count, reporting five typical cases of the sixty-two belonging to this group.

2. Pyorrhea cases with fair to normal hemoglobin content and erythrocyte count and slight leucopenia present, reporting five typical cases of the thirty-one belonging to this group.

3. Pyorrhea cases where the pockets extended into the periapical area with fair to normal hemoglobin content and erythrocyte count and slight to moderate leucocytosis present, reporting five typical cases of the seventeen belonging to this group.

4. Cases of chronic periapical infection not having evacuating sinuses, with pyorrhea co-existing and with fair to normal hemoglobin content and erythrocyte count and slight to moderate leucocytosis present, reporting five typical cases of the nineteen belonging to this group. Also reporting under this group the single case of pronounced anemia presenting in the entire series.

5. Cases of chronic periapical infection not having evacuating sinuses and the body thought to be free from all other focal infective processes, with fair to normal hemoglobin content and erythrocyte count and slight to moderate leucocytosis present, reporting ten typical cases of the twenty-nine belonging to this group.

6. Cases of chronic periapical infection not having evacuating sinuses and the body thought to be free from all other focal infective processes, with fair to normal hemoglobin content and erythrocyte count and moderate leucopenia present, reporting two typical cases of the four belonging to this group.

Group I.

Pyorrhea cases with fair to normal blood count, reporting five typical cases of the sixty-two belonging to this group.

Hemanalysis.

	Case 17. Mrs. H. June 24, 1914. Age 38.	Case 6. Mrs. D. April 10, 1914. Age 59.
*Hemoglobin	85%	90%
**Erythrocytes	4,472,000	4,772,000
**Leucocytes	7,800	7,400
Polymorphonuclears	64%	65%
Large Mononuclears	4%	4%
Small Mononuclears	32%	31%
Eosinophiles	0	0
Blood Pressure. (Tycos) Systolic	132	140
Blood Pressure. (Tycos) Diastolic	90	98
Pulse pressure	42	42
Teeth lost from pyorrhea	3	4
Teeth extensively involved	28	22

	Case 128. Mr. H. March 28, 1915. Age 59.	Case 26. Mr. F. May 27, 1914. Age 58.
Hemoglobin	97%	90%
Erythrocytes	5,088,000	4,712,000
Leucocytes	7,000	7,000
Polymorphonuclears	63%	65%
Large Mononuclears	9%	2%
Small Mononuclears	26%	31%
Eosinophiles	2%	2%
Blood Pressure. Systolic	132	153
Blood Pressure. Diastolic	100	105
Pulse pressure	32	48
Teeth lost from pyorrhea	6	8
Teeth extensively involved	25	21

*Sahli.
**Per cu. mm.

Case 24. Mrs. N. May 13, 1915. Age 44.

Hemoglobin	80%
Erythrocytes	4,408,000
Leucocytes	7,000
Polymorphonuclears	65%
Large Mononuclears	4%
Small Mononuclears	30%
Eosinophiles	1%
Blood Pressure. Systolic	114
Blood Pressure. Diastolic	80
Pulse pressure	34
Teeth lost from pyorrhea	1
Teeth extensively involved	29

Group 2.

Pyorrhea cases with fair to normal hemoglobin content and erythrocyte count and slight leucopenia present, reporting five typical cases of the thirty-one belonging to this group.

Hemanalysis.

	Case 11.—A. Mrs. G. M. April 6, 1914. Age 46.	**Case 11.—B.** Second examination. May 7, 1915.
Hemoglobin	80%	94%
Erythrocytes	4,488,000	4,632,000
Leucocytes	6,000	8,000
Polymorphonuclears	60%	61%
Large Mononuclears	5%	6%
Small Mononuclears	35%	32%
Eosinophiles	0	1%
Blood Pressure. Systolic	114	
Blood Pressure. Diastolic	80	
Pulse pressure	34	
Teeth lost from pyorrhea	5	
Teeth extensively involved	21	

Second blood examination made some months after infection was controlled.

Case 67.	Mrs. F. Nov. 12, 1914. Age 39.	Case 119.	Mrs. A. March 1, 1915. Age 33.
Hemoglobin	87%		92%
Erythrocytes	4,552,000		4,308,000
Leucocytes	6,400		6,600
Polymorphonuclears	63%		63%
Large Mononuclears	5%		7%
Small Mononuclears	32%		30%
Eosinophiles	0		0
Systolic	125		120
Blood Pressure. Diastolic	94		90
Pulse pressure	31		30
Teeth lost from pyorrhea	3		2
Teeth extensively involved	19		15

Case 135.	Mrs. P. Sept. 19, 1914. Age 57.	Case 65.	Mrs. S. Oct. 27, 1914. Age 62.
Hemoglobin	88%		88%
Erythrocytes	4,024,000		4,640,000
Leucocytes	5,600		6,600
Polymorphonuclears	54%		58%
Large Mononuclears	4%		9%
Small Mononuclears	39%		31%
Eosinophiles	3%		2%
Systolic	130		120
Blood Pressure. Diastolic	90		92
Pulse pressure	40		28
Teeth lost from pyorrhea	5		15
Teeth extensively involved	15		9

Group 3.

Pyorrhea cases where the pockets extended into the periapical area, with fair to normal hemoglobin content and erythrocyte count and slight to moderate leucocytosis present, reporting five typical cases of the seventeen belonging to this group.

Case 77.—A. Miss L. April 10, 1914. Age 46.		Case 77.—B. Second examination. June 18, 1914.
Hemoglobin	83%	87%
Erythrocytes	4,392,000	4,384,000
Leucocytes	9,000	7,000
Polymorphonuclears	65%	65%
Large Mononuclears	7%	8%
Small Mononuclears	25%	27%
Eosinophiles	3%	0
Systolic	120	
Blood Pressure. Diastolic	84	Second examination made some months after infection was controlled.
Pulse pressure	36	
Teeth lost from pyorrhea	3	
Teeth extensively involved	20	
Pockets involving root ends	3	

Case 8. Mrs. G. April 15, 1915. Age 52.		Case 10. Mr. R. April 14, 1914. Age 58.
Hemoglobin	90%	99%
Erythrocytes	4,856,000	4,744,000
Leucocytes	8,400	8,800
Polymorphonuclears	66%	63%
Large Mononuclears	8%	7%
Small Mononuclears	26%	30%
Eosinophiles	0	0
Systolic	136	160
Blood Pressure. Diastolic	92	120
Pulse pressure	44	40
Teeth lost from pyorrhea	5	5
Teeth extensively involved	15	15
Pockets involving root ends	3	5

Case 37. Mr. F. July 1, 1914. Age 49.		Case 71. Mrs. E. Nov. 19, 1914. Age 43.
Hemoglobin	90%	92%
Erythrocytes	4,424,000	4,928,000
Leucocytes	8,200	8,200

(*Case 37 continued*)		(*Case 71 continued*)	
Polymorphonuclears	67%		67%
Large Mononuclears	6%		4%
Small Mononuclears	26%		28%
Eosinophiles	1%		1%
Systolic	118		120
Blood Pressure. Diastolic	84		89
Pulse pressure	34		31
Teeth lost from pyorrhea	2		3
Teeth extensively involved	18		19
Pockets involving root ends	2		2

Group 4.

Cases of chronic periapical infection not having evacuating sinuses, with pyorrhea co-existing and with fair to normal hemoglobin content and erythrocyte count and slight to moderate leucocytosis present, reporting five typical cases of the eighteen belonging to this group.

Hemanalysis.

Case 70.—A. Miss A. Nov. 16, 1914. Age 63.		Case 70.—B. Second examination. Dec. 14, 1914.	
Hemoglobin	81%		88%
Erythrocytes	4,344,000		4,368,000
Leucocytes	9,600		7,400
Polymorphonuclears	69%		66%
Large Mononuclears	7%		7%
Small Mononuclears	23%		26%
Eosinophiles	1%		1%
Systolic	136		
Blood Pressure. Diastolic	102		
Pulse pressure	34		
Teeth lost from pyorrhea	3		
Teeth extensively involved	13		

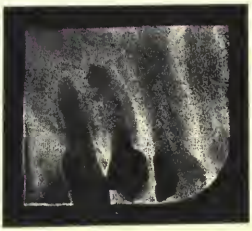

Fig. 1.

Periapical infection about second bicuspid as shown in Fig 1.

The normal blood count shown in the second examination was

brought about by treatment of the periapical infection through the root canal. The blood count did not change to normal with the pyorrhea treatment.

Case 28.	Mr. M. June 1, 1914. Age 44.	Case 72.	Mr. S. Nov. 23, 1914. Age 59.
Hemoglobin	97%		93%
Erythrocytes	4,800,000		4,736,000
Leucocytes	9,800		13,000
Polymorphonuclears	66%		75%
Large Mononuclears	4%		2%
Small Mononuclears	30%		22%
Eosinophiles	0		1%
Systolic	143		116
Blood Pressure. Diastolic	106		90
Pulse pressure	37		26
Teeth lost from pyorrhea	2		7
Teeth extensively involved	23		23
Periapical infections	1 . . moderate		2 . . moderate

Case 110.—A.	Mrs. W. Feb. 19, 1915. Age 53.	Case 110.—B.	Second examination April 9, 1915.
Hemoglobin	97%		91%
Erythrocytes	4,768,000		4,536,000
Leucocytes	9,000		7,000
Polymorphonuclears	67%		58%
Large Mononuclears	7%		6%
Small Mononuclears	25%		33%
Eosinophiles	1%		3%
Systolic	120		
Blood Pressure. Diastolic	80		
Pulse pressure	40		
Teeth lost from pyorrhea	3		
Teeth extensively involved	15		

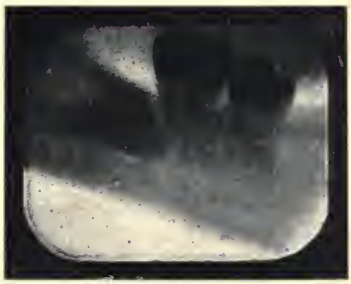

Fig. 2.

Infection about impacted tooth shown in Fig. 2.

Pyorrhea not treated in this case—the imbedded bicuspid was removed and the infected area curetted. The blood count returned to normal with the presence of pyorrhea as shown by the second examination.

Case 96.—A. Miss G. Jan. 15, 1915. Age 31.		**Case 96.—B.** Second examination. June 16, 1915.	
Hemoglobin	91%		90%
Erythrocytes	4,556,000		4,456,000
Leucocytes	13,400		7,800
Polymorphonuclears	73%		62%
Large Mononuclears	5%		2%
Small Mononuclears	22%		36%
Eosinophiles	0		0
Blood Pressure. Systolic	120		
Blood Pressure. Diastolic	85		
Pulse pressure	35		
Teeth lost from pyorrhea	none		
Teeth extensively involved	10		
Periapical infections	1 moderate		

Second blood examination was made after the infection was brought under control.

Case 175. Dr. Y. Age 44.

	Aug. 15, 1913	Aug. 25	Sept. 15	Sept. 20
Erythrocytes	2,300,000	1,500,000	3,200,000	3,800,000
	Oct. 10	Nov. 10	Nov. 25	Dec. 19
"	4,000,000	4,028,000	4,300,000	4,700,000

Periapical infections.... 1 ....moderate, and advanced pyorrhea. Tooth extracted and area curetted, and pyorrhea treated during the month of October.

This pronounced case of anemia was held by the various physicians in charge to be due to the oral sepsis associated with his teeth. The patient at the present time is in reasonably good health and carrying on his practice of medicine and surgery as formerly.

Group 5.

Cases of chronic periapical infection not having evacuating sinuses and the body thought to be free from all other focal infective processes, with fair to normal hemoglobin content and erythrocyte count and slight

to moderate leucocytosis present, reporting ten of the twenty-nine belonging to this group.

Hemanalysis.

Case 106.—A. Miss G. Feb. 12, 1915. Age 46.		Case 106.—B. Second examination. April 21, 1915.	
Hemoglobin	91%		96%
Erythrocytes	4,456,000		4,784,000
Leucocytes	11,200		7,000
Polymorphonuclears	74%		61%
Large Mononuclears	2%		5%
Small Mononuclears	24%		32%
Eosinophiles	0		2%
Blood Pressure. Systolic	138		
Diastolic	100		
Pulse pressure	38		

Area of chronic infection about impacted cuspid shown in Fig. 3. Impacted tooth removed and area curetted, February 12, 1915.

Fig. 3.

Case 54.—A. Mr. P. Sept. 28, 1914. Age 23.		Case 54.—B. Second examination. Nov. 2, 1914.	
Hemoglobin	89%		96%
Erythrocytes	4,640,000		5,016,000
Leucocytes	14,200		7,000
Polymorphonuclears	79%		65%
Large Mononuclears	5%		5%
Small Mononuclears	16%		30%
Eosinophiles	0		0

Periapical infections.... 1 ....moderate.
Tooth removed and area surgically treated September 28, 1914.

Case 78.	Mr. G. Dec. 31, 1914. Age 56.	Case 120.	Miss D. Mar. 2, 1915. Age 35.
Hemoglobin	94%		92%
Erythrocytes	4,816,000		4,472,000
Leucocytes	8,800		8,800
Polymorphonuclears	64%		68%
Large Mononuclears	4%		6%
Small Mononuclears	30%		26%
Eosinophiles	2%		0
Blood Pressure. Systolic	130		132
Blood Pressure. Diastolic	92		100
Pulse pressure	38		32
Periapical infections	2 moderate		1 slight

Case 143.	Mr. W. April 21, 1915. Age 50.	Case 145.	Mrs. R. April 25, 1915. Age 49.
Hemoglobin	97%		97%
Erythrocytes	4,776,000		4,688,000
Leucocytes	11,600		9,000
Polymorphonuclears	74%		68%
Large Mononuclears	7%		7%
Small Mononuclears	18%		24%
Eosinophiles	1%		1%
Blood Pressure. Systolic	138		128
Blood Pressure. Diastolic	96		90
Pulse pressure	42		38
Periapical infections	2 slight 1 moderate		1 slight

Case 81.—A.	Mrs. S. Jan. 7, 1915. Age 49.	Case 81.—B.	Second examination. Jan. 18, 1915.
Hemoglobin	89%		95%
Erythrocytes	4,586,000		4,776,000
Leucocytes	11,200		8,800
Polymorphonuclears	70%		64%
Large Mononuclears	4%		5%

(*Case 81a continued*)

Small Mononuclears.....	25%
Eosinophiles	1%
Systolic	124
Blood Pressure. Diastolic..	90
Pulse pressure...	34

Periapical infections. . . . 1 . . . . . moderate as shown in Fig. 4. Second blood examination was made eleven days after the cavity was curetted.

(*Case 81b continued*)

.....	30%
.....	1%

Fig. 4.

Case 68.—A. Mr. T. Nov. 14, 1914. Age 61.

Hemoglobin	90%
Erythrocytes 4,832,000	
Leucocytes	12,800
Polymorphonuclears	73%
Large Mononuclears.....	4%
Small Mononuclears.....	22%
Eosinophiles.....	1%
Systolic	137
Blood Pressure. Diastolic..	100
Pulse pressure...	37

Case 68.—B. Second examination. Nov. 20, 1914.

.....	92%
.....4,936,000	
.....	10,000
.....	62%
.....	8%
.....	29%
.....	1%

Case 68.—C. Third examination. Jan. 23, 1915.

Hemoglobin	94%
Erythrocytes 4,888,000	
Leucocytes	8,000
Polymorphonuclears	60%
Large Mononuclears.....	9%
Small Mononuclears.....	30%
Eosinophiles	1%

Periapical infections.... 3 ....moderate.

This patient was suffering from neurasthenia of two years' standing, which showed immediate improvement with eradication of the infected foci. He has practically regained his normal health at this time without other than the surgical treatment indicated.

Case 64.—A. Dr. Mc. Oct. 23, 1914. Age 48.		**Case 64.—B.** Second examination. Oct. 29, 1914.
Hemoglobin	70%	88%
Erythrocytes	4,440,000	4,704,000
Leucocytes	10,400	8,200
Polymorphonuclears	72%	63%
Large Mononuclears	1%	7%
Small Mononuclears	25%	30%
Eosinophiles	2%	0
Systolic	130	
Blood Pressure. Diastolic	100	
Pulse pressure	30	

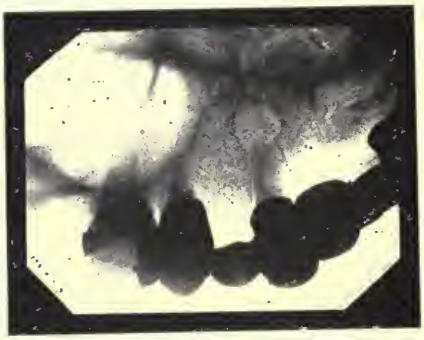

Fig. 5.

Case 64.—C. Third examination. Nov. 4, 1914.	
Hemoglobin	93%
Erythrocytes	4,732,000
Leucocytes	7,600
Polymorphonuclears	64%
Large Mononuclears	6%
Small Mononuclears	29%
Eosinophiles	1%

Periapical infection.... 2 ....moderate, one shown in Fig. 5.

A brief report of the history of Case 64 is here published, as a fair example of one of the usual findings in this group.

History.— Presented with serous iritis. All causative factors with the exception of the pyorrhea about the four lower incisors had been excluded. The chronic infection about these teeth thought to be the definite cause of the iritis. Teeth extracted one week ago, patient feels there has been some improvement since the extraction of the teeth. Mouth had been examined and declared to be free from all chronic infection.

Examination.— Film radiograph of all pulpless teeth were advised. Two bone abscesses were found—more important about upper left cuspid and lower right second bicuspid. Blood examination taken previous to the extraction of the teeth about which bone abscesses were found showed effects of chronic infection upon the system.

Operation.— Teeth extracted and bone cavities curetted.

Oct. 24, 1914.— Teeth to be extracted were dried and crowns painted with tincture of iodin and the area protected with sterile gauze. Teeth then carefully removed to prevent bacterial contamination—root ends amputated with sterile saw and placed in sterile bottles—sent to the Columbus Medical Laboratories for ærobic and anærobic tests for the presence of bacteria.

Nov. 3, 1915.— Vision reported normal by those in charge.
Columbus Medical Laboratories' Report.
Specimen of two teeth.

Upper Tooth.— Ærobic:
Streptococci—present (Streptococcus pyogenes).
Staphylococci—present (Staphylococcus pyogenes aureus).
Saprophytic bacilli—present.
Anærobic:
Pus cocci—present.
Proteus bacillus—present.

Lower (dry tooth).—
Ærobic:
Staphylococci—present (Staphylococcus pyogenes aureus).
Saprophytic bacilli—present
Anærobic:
Very few cocci grew.

Case 79.—A.	Mr. B. Jan. 2, 1915. Age 32.	Case 79.—B.	Second examination. Jan. 29, 1915.
Hemoglobin	93%		100%
Erythrocytes	4,840,000		5,304,000
Leucocytes	9,600		10,000
Polymorphonuclears	70%		70%
Large Mononuclears	5%		4%
Small Mononuclears	25%		23%
Eosinophiles	0		3%
Blood Pressure. Systolic	124		
Blood Pressure. Diastolic	98		
Pulse pressure	26		

Fig. 6.

Periapical infections. . . . 1 . . . . slight as shown in Fig. 6.

Began root canal treatment on January 8th, but was unable to reach the apex with instruments until February 2nd.

Case 79.—C	Third examination. Feb. 12, 1915.	Case 79.—D.	Fourth examination. Mar. 18, 1915.
Hemoglobin	100%		102%
Erythrocytes	5,016,000		5,128,000
Leucocytes	8,000		8,800
Polymorphonuclears	60%		66%
Large Mononuclears	8%		3%
Small Mononuclears	30%		30%
Eosinophiles	2%		1%

The above examination was made ten days after remedies had been applied to the root end—with five days intermission. Root canal filling placed March 15th, but the radiograph taken showed the apical third unfilled.

The above examination taken three days after the root canal filling was placed shows the infective process again becoming active.

Case 79.—E. Fifth examination. Aug. 16, 1915.

Hemoglobin	100%
Erythrocytes	4,976,000
Leucocytes	10,400
Polymorphonuclears	72%
Large Mononuclears	2%
Small Mononuclears	24%
Eosinophiles	2%

Fig. 7.

The root canal filling was removed on April 6th and a number of unsuccessful efforts made to enlarge the canals to the apex. A treatment was placed on May 25th and further attention discontinued. On August 16th the blood examination showed the re-establishment of the infective process, practically corresponding to the findings recorded January 2nd.

Group 6.

Cases of chronic periapical infection not having evacuating sinuses and the body thought to be free from all other focal infective processes, with fair to normal hemoglobin content and erythrocyte count and moderate leucopenia present, reporting two of the four belonging to this group.

Hemanalyss.

Case 123.—A. Dr. P. Mar. 5, 1915. Age 44.		**Case 123.—B.** Second examination. Aug. 26, 1915.	
Hemoglobin	94%		95%
Erythrocytes	4,712,000		4,888,000
Leucocytes	5,000		7,200
Polymorphonuclears	50%		61%
Large Mononuclears	8%		4%
Small Mononuclears	41%		33%
Eosinophiles	1%		2%
Blood Pressure. Systolic	130		
Blood Pressure. Diastolic	90		
Blood Pressure. Pulse pressure	40		
Periapical infections	1 moderate	Periapical infections	1 moderate

(See Fig. 8)

Case 157. Dr. H. May 24, 1915.
Age 56.

Hemoglobin	92%
Erythrocytes	4,840,000
Leucocytes	5,800
Polymorphonuclears	58%
Large Mononuclears	3%
Small Mononuclears	37%
Eosinophiles	2%

(Radiograph of this case shown in Fig. 9.)

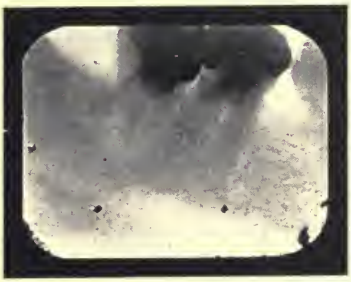

Fig. 8.

Fig. 9.

Discussion of Groups, Cases and Conclusions.

In the examinations as here made, I found in 100 out of 162 cases that blood changes had occurred that were held to be the sequence of chronic oral infections associated with teeth.

Anemia. That neither pronounced nor moderate anemia was commonly associated with chronic oral infections in this series, as claimed by many authors; however pronounced anemia was found once as shown in Case No. 175, in group 4.

Leucopenia. That leucopenia was more constant than leucocytosis in pyorrhea cases where the blood findings were abnormal; furthermore, leucopenia was more frequent in those cases where the pyorrhea pockets did not involve the root ends and in the absence of periapical focal infection without discharging sinuses.

Leucocytosis. That leucocytosis when associated with pyorrhea cases was most frequent where the pyorrhea pockets extended nearly to or did involve the root ends.

That abnormal blood findings were present in forty-eight of the

one hundred and ten pyorrhea cases examined. Full urinalysis was made of all pyorrhea cases although not here reported.

That leucocytosis was present in forty-seven of the fifty-two cases of periapical infections without discharging sinuses—but that leucopenia does occur under the same conditions is presented in Group 6. Let the foregoing statement be not misconstrued to mean that either leucocytosis or leucopenia is always present when a chronic periapical infection without a discharging sinus is found, for periods arise when the effect of the infective biproducts is so slight that its result is not manifested in a blood change. But, since severe secondary infections could occur during this period, a focal infection although producing no characteristic blood change must always be looked upon as a menace to the health of the patient and its eradication demanded.

Interesting Case Involving Defective Root Filling.

I desire to call particular attention to two cases, Nos. 70 and 79, wherein secondary effects resulted from the periapical infection shown in the illustration accompanying the reports. In Case No. 79, a few days after the dentist had been able to carry the remedy to or through the root end, the blood count changed to normal and the secondary involvement began to improve and continued to do so until a brief period after the root canals were filled; then upon complaint from the patient that the original secondary trouble had returned, another blood count was taken which showed a slight leucocytosis. A radiograph then taken proved that the root canals had not been more than two-thirds filled. The root canal filling was removed and treatment again undertaken. The dentist in charge decided he would be unable to perfectly fill the canals, and the patient was allowed to go with the remedy in the tooth for six weeks. The neuritis increased and the blood examination taken six weeks after the last treatment had been placed showed it to be practically the same as the original count. On August 21st, I removed the tooth and curetted the periapical area. The blood count taken three days after this was Hemoglobin 102, Erythrocytes 5,000,800, Leucocytes 8,400, Polys 63, Large 5, Small 32.

Case 70 was a patient thought to be suffering only from pyorrhea and the blood examination showed slight leucocytosis which did not materially change after treatment, nor did the first series of radiographs of the teeth show a definite rarefied area, but upon Ferradic test a pulpless bicuspid was found. This tooth was treated, root canal filled—the secondary involvement disappeared and the blood count returned to normal.

Periapical Infections.

This gives me the opportunity to focus the attention of those called upon to determine the presence of chronic focal infections associated with teeth, not to confine their examinations only to the supporting structures and radiographs taken of the roots to outline rarefied areas, for one may have a pulpless tooth present without a rarefied periapical area and at the same time have a chronic infective process in the remnants of pulp tissue, which I have found in three cases to be accountable for a serious secondary effect.

Nor can one with any degree of assurance eradicate periapical infections by the mere extraction of teeth unless it be accompanied by a curettement, for in two instances I have had patients go several months without any symptoms of the original secondary involvements and then have noted their reappearance without the development of any new focal infections, and upon making blood examinations I found the possible evidence of a chronic infection, although the tissue had healed with every appearance of being normal over the area where the tooth was removed. I then opened into the old infected tract, curetted it and in one instance the patient had a definite reaction similar to that experienced after injection of an autogenous vaccine during the original treatment. A second patient had a less marked reaction. Therefore it becomes necessary to do something more than to extract teeth or amputate roots and do an indifferent curettement to secure positive elimination of focal infections associated with teeth.

In closing this communication I wish to express my appreciation of Hunter's early studies upon the effects of oral sepsis and the valuable contributions of Billings and his associates upon the systemic effects of chronic focal infections.

The Necessity for the Use of the Radiograph in Orthodontia.

By Dr. A. H. Ketcham, Denver, Colorado.

The radiograph is just as important to the orthodontist as Dr. Brownlie, in the preceding paper, has shown it to be to the general practitioner; and without access to an X-ray apparatus, so that it may be used as freely as ownership would imply, the orthodontist cannot give his patients that service which they have a right to expect.

Impacted Teeth.

There are many cases of impacted teeth, and the operator gropes in the dark unless he has determined their exact position before beginning treatment. (Figs. 1 to 7.) Frequent use of the X-ray is required thereafter to determine the movement of the impacted tooth. Fig. 1 shows an impacted cuspid lying in the palate and nearly in a horizontal plane, with the apex of the root opposite that of the second premolar. The shadow of the end of the lateral incisor root cannot be seen through the crown of the cuspid, therefore it was assumed that the root presented a case either of resorption or arrested development. In the essayist's opinion the latter is more probable.

Fig. 2 shows the checking up of the cavity which was drilled to receive a pin after the tissues had been cut away and the opening over the crown of the tooth packed with antiseptic dressing for several days.

Fig 3 shows attachment to the cuspid by means of a pin carrying retaining tube for the .030″ wire. Into the tube was inserted the end of the .030″ spring wire which projects from the .030″ arch of the pin and tube appliance. Pressure was exerted in a lingual direction so as to move the crown of the cuspid away from the end of the lateral incisor root. This picture shows that space has been gained at this point. Previous to this time pressure upon the lateral incisor crown produced a sensation of grating as the root end rubbed against the crown of the cuspid.

Fig 4 shows the cuspid crown moved away from the lateral incisor root, and that the cuspid is moving downward. At this point connection between the projecting .030″ wire and the tube attached to pin in tooth was through a wire ligature in order to give an universal joint.

Fig. 5 shows another step in the downward movement of the cuspid.

and that the apex of its root has moved a greater distance from the root of the second premolar. The length of the pin cemented in cavity in cuspid is shown. This gives an idea of the thickness of the gum tissue overlaying the cuspid crown when treatment was started, for at that time the outer edge of tube was level with gum tissue.

Fig. 1.

Fig. 2.

Fig. 3.

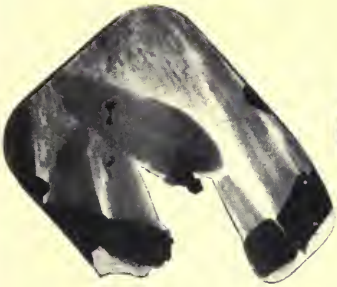

Fig. 4.

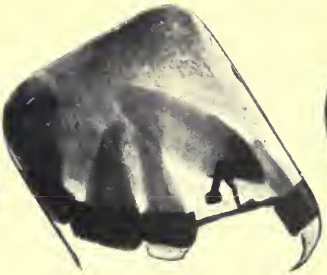

Fig. 5.

Fig. 6.

Fig. 6 shows the cuspid nearly down in position, where it is being rotated.

Fig. 7 shows the crown of cuspid in place. After a few weeks' rest a band carrying tube was placed upon the crown and pin upon the arch, then gentle pressure exerted to start the root in labial movement.

The blunt end of lateral incisor root will be observed. It will also be noted that there is but a small amount of alveolar process around the root, yet the pulp is vital and the tooth fairly firm.

The essayist doubts if this tooth movement could have been accomplished at all without the aid of the radiograph; and doubts if it could have been carried on so successfully without the use of either Dr. Angle's pin and tube, or ribbon and bracket appliance.

Failure of Development.

The frequency with which some of the permanent teeth fail to develop is not appreciated by orthodontists or general practitioners. This unfortunate condition is present in a large enough percentage of cases to make the orthodontist guilty of gross carelessness

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

unless he systematically examines by means of the radiograph the region around the temporary teeth.

In examining over three hundred cases the essayist found ten per cent. with some of the permanent teeth, which should succeed the temporary teeth, absent. Of these, twenty-three cases have mandibular second premolars absent; ten cases have one or more maxillary lateral incisors absent; six cases have maxillary premolars absent; two cases have mandibular first premolars absent. The first condition is present in such a large percentage of cases that it occasions no surprise to the experienced operator to discover a mandibular second premolar absent when going through the regular routine of checking up temporary teeth with the radiograph. (Fig. 8.)

Determining the Length of Roots.

Now that the public and the profession are becoming educated to the importance of beginning the treatment of orthodontic cases early, even before any of the deciduous teeth are lost, a larger percentage of our work is for children from four to seven years

Fig. 12.

Fig. 13.

Fig. 14.

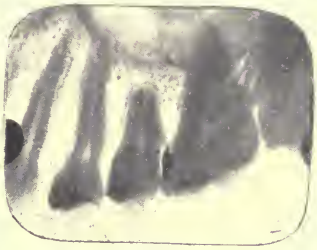

Fig. 15.

of age. In these cases not only is it necessary to determine the presence of the permanent successors of the temporary teeth, but it is of great value to determine the length of the roots of temporary teeth to decide whether to use for anchorage. (Figs. 9, 10.) Then, too, the radiographs in the incisive region impress upon the parents of the little patients the necessity for prompt treatment. (Figs. 11, 12.)

Radiographs of temporary molars which are decayed give an idea of the time when the premolars will erupt and show parents the necessity oftentimes for immediate filling of the temporary molars.

Observation of the Roots of Permanent Teeth.

Radiographic observation of the length and shapes of the roots of permanent teeth before orthodontic procedure will sometimes cause the orthodontist to modify his course of treatment.

All teeth which are to be moved should be radiographed before the placing of appliances on account of criticism which may come up if later the roots are found to be short. Teeth with large, well-formed crowns may have very short roots. (Fig. 13.) In cases where the appliance is placed upon such teeth without radiographs, and later it is discovered that the roots are short, the natural tendency is to lay the blame upon the operator and the appliances. Sometimes radiographs reveal a tooth with the root end blunt, as though development had been arrested. (Figs. 14, 15.) Some made by the essayist are of cases which have been treated by the orthodontist; others of cases where there has been no orthodontic interference. At the present time there is an orthodontist who is fearing a lawsuit because short roots have been discovered in a case where he neglected to have radiographs made before starting treatment.

There is a field in orthodontia which, until recently, has been entirely overlooked; that is, radiographic observation of the behavior of roots of permanent teeth during orthodontic treatment. The essayist believes that much of value to orthodontia will be learned through this means, and in closing urges all orthodontists to use the X-ray freely.

The Value of Bacterial Vaccines in the Treatment of Pyorrhea.

By George Bailey Harris, D.D., Sc.M., Detroit, Mich.
(From the Research Laboratories of Parke, Davis & Co.)

For centuries it has been known that recovery from certain diseases produces a change somewhere within the body which lessens susceptibility toward reinfection or produces a total immunity for a certain period, varying in different diseases. When the etiology of many of these diseases was discovered to be due to certain organisms called bacteria, many attempts were made to develop an immunity by injecting killed or attenuated cultures of the bacteria into the body.

After contraction of disease, active immunization has again become important. This is due to the recent work of Dr. Wright. It is also important to keep in mind the fact that Dr. Wright used bacterial vaccines before he discovered opsonins and their importance in the production of immunity.

From later studies he has come to the conclusion that opsonins are of great importance in immunity to some diseases, but that they are decreased in amount during most infections, and that they can be greatly increased by the injection of bacterial vaccines. The cause for the decrease in inactive infections is probably due to the action of the toxins elaborated by the bacteria, destroying the tissue cells before they can liberate opsonins.

Bacterial substances and products are absorbed by bacterial infections. According to the amount of substance and products absorbed, immune bodies are produced. When a quantity of substance and products are absorbed sufficient immune bodies are generally produced to effect a cure of the disease; but when little absorption takes place there are not enough immune bodies produced to cure the disease, and then the infection becomes chronic. This is the case with pyorrhea. On account of the localization of the infection very little, if any, absorption of substance takes place, resulting in a chronic infection. In order to produce enough immune bodies to effect a cure from pyorrhea the well-known principles of active immunization must be employed.

Injections for Immunization.

This method is to actively immunize, by the injection at the proper time and in the proper doses, of killed cultures of the organisms causing the infection. The effect of these injections is to produce certain changes in the opsonic content. The dose should be of such size as to produce only a slight negative phase, lasting only a short time. This is followed by a long positive phase. When the positive phase is at its height another injection should be given so that the negative phase of the second injection will fall on the positive phase of the first injection. The positive phase of the second will then start before the first positive phase returns to normal, carrying the opsonic content still higher. Unless the proper dose is given and so spaced that the index will be continually carried higher and higher, no beneficial results may be expected. If the index shows a marked drop after an injection, the dose has been too large.

In pyorrhea we have a local chronic infection with the bacteria walled off by Nature to prevent a general infection. Little or no absorption of bacterial substances or products can take place under these conditions, preventing any immunizing bodies from being produced. If, however, bacterial vaccines are employed these immunizing bodies are produced in sufficient numbers to produce a cure, provided they are able to reach the infected area. If, by surgical means, this walled-off area is broken down so that the blood can get in, carrying these immunizing bodies, the bacteria will quickly be destroyed. Furthermore, these bodies will continue to be produced for a long time after the infection has been cleared up, protecting the patient against a reinfection during the process of repair. Vaccine treatment is the only treatment that offers protection from reinfection during the process of repair. This is an important factor in the treatment of pyorrhea.

Antiseptics in Pyorrhea.

When we depend entirely upon antiseptics in treating pyorrhea there is an important factor that should be considered; that is, that bacteria are not fixed, but under certain conditions are able to undergo fundamental changes. Biologic variations so commonly found in the higher forms of life, both animal and plant, also occur in the lower forms, although they may not be noticeable, due to the simplicity of the organisms. Bacteria are able to protect themselves when unfavorable conditions arise. They quickly undergo fundamental changes and adjust themselves to these new conditions. They are able to protect themselves against chemical agents so that they no longer have the destructive action they formerly had. Moreover, they will retain this immunity for a long

time after the chemical agent to which they were subjected has been removed.

The Amœba as a Cause of Pyorrhea Alveolaris.

While this paper primarily deals with vaccines, the author will ask your permission to cross the fence and consider briefly the endamœba which has recently come upon the dental horizon. While it is too early to draw positive conclusions in regard to emetin, the author would say that his results with emetin have been discouraging. What proof have we that the endamœba is the cause of pyorrhea?

The fact that the endamœba is eliminated from the mouth after a few injections or local applications of emetin cannot be accepted as proof that it causes pyorrhea. The presence of the endamœba in the mouth does not indicate that it plays any part in this etiology. The author has repeatedly tried to produce pyorrhea in animals by means of the endamœba, without success. The introduction of a streptococcus after the endamœba had failed produced pyorrhea upon the first introduction of the streptococcus.

Effects of Emetin.

There are many cases reported where the pus was stopped with emetin; beneficial results, to be sure. The author does not doubt that pus can be checked in the gums with emetin, although he frankly admits that the diminution through emetin, in the cases in which he has tried it, has not been to any marked degree. But did the destruction of the endamœbæ cause the cessation of pus? Did it ever occur to those reporting these cases that the endamœba is not capable of producing pus? The elimination of the endamœba, in the writer's mind, has no connection with the cessation of pus when the elimination of the pus has followed the use of emetin. What probably occurred was this: The emetin inhibited the growth of the streptococcus first and of the staphylococcus later, for the staphylococcus is much more resistant to destructive agents than most non-spore producing bacteria. When the staphylococcus is inhibited and their numbers reduced the pus disappears. I do not say it is eliminated entirely. It simply becomes a minus quantity, unless a platinum loop is put down into the pus pocket and a plant made. Streptococci and staphylococci will then appear. As soon as the emetin is discontinued, the bacteria regain their virulence and numbers and pus again begins to ooze from the gums. This conclusion is drawn from a series of experiments which are described here.

Pyorrhea Alveolaris Induced in Lower Animals.

Pyorrhea was induced in animals, using streptococcus pyogenes and staphylococcus albus. When a pus pocket had been formed and a free discharge of pus obtained, the emetin treatment was instituted. Four injections caused a cessation of pus. A bac-

Fig. 1.

terial examination of the pockets showed the streptococcus and staphylococcus to be present, but their numbers were greatly reduced and their virulence as compared with their virulence before the injections were given was much less. They were also attenuated. The treatment was resumed in the hope that the bacteria might be totally eliminated from the tissues. Six more injections were given and another bacterial examination made. This was done at the end of each injection after the fourth. The bacteria were still present in about the same numbers as they were at the end of four injections, the last six apparently having no effect upon them. To date the author cannot say whether it is possible to eliminate the bacteria entirely by the use of emetin, as no animal has survived the emetin treatments long enough to complete the experiments. From the present indications the author does not believe that bacteria can be eliminated by emetin. The result of these experiments, while they were not carried to completion, tend to show that the beneficial results obtained from the use of emetin was not the result of the elimination of the endamœba, but its inhibitory action on the strepto-

coccus and the staphylococcus. Assuming that later it should be proven that emetin will bring about the total destruction of the involved bacteria, it would not effect the tissue resistance in any way; it would not produce an immunity, as vaccines do; thus the necessity would exist for the continued administration of emetin until the pockets were filled in to prevent a reinfection and return of pyorrhea.

Fig. 2.

Case Histories.

Case I.

A traveling salesman, representing a drug house, called on the author. In the course of our conversation the subject of pyorrhea came up. He asked me if I used emetin. I replied that I did not use it. He then told me that he had taken the treatment. He said he certainly was benefited for a time and seemed to be completely cured, but a month later, as he put it, "it started on a grand slide the other way." Two months afterward he was as bad as ever. His case, with others, was reported as cured in one of our dental journals. Fig. 1 shows this gentleman four months after being "cured."

Case II.

This gentleman had been troubled with rheumatism for over two years, for which he had been unsuccessfully treated for pyorrhea both locally and with emetin. By the use of vaccines this result was obtained (Fig 2).

Since his recovery from pyorrhea he has not been troubled with rheumatism. Local treatment was used, to be sure, but not until the pus was stopped.

Fig. 3.

Fig. 4.

Case III. Here is another case in which emetin was first used, the endamœbæ being very prolific. The treatment was a great disappointment to the author. Vaccines were used and considerable improvement was obtained, but a cure was not effected, due partly to syphilis.

Case IV. Whenever there is a case reported where vaccines have been used, combined with local treatment, there is room for some to contend that the local treatment, and that alone, was responsible for the result obtained,

giving no credit to vaccines whatever. The case shown here (Fig. 4) was treated with vaccines and vaccines alone. There were no instructions given as the care of the teeth or the use of the toothbrush. He lived exactly as he had been living except that he was given vaccines, and

Fig. 5.

remember, please, no local treatment. This picture (Fig. 4) shows the condition before treatment. Five injections of stock vaccine were given every five days without any reaction that was noticeable and with the discomfort of the injections only. The result as shown in Fig. 5 was obtained. If vaccine treatment did not produce this result, pray tell me what did? But this case is not completed until the calcic deposits seen around the gum margins are completely removed.

Stock Vaccines.

Let me say just a word about stock vaccines. I had always been an ardent supporter of autogenous vaccines until I made a careful study of autogenous and stock vaccines. I know that stock vaccines are looked upon as being extremely unscientific, but they are often used by those who criticize them the most. The autogenous vaccine is effective if one or more strains are not left out that are acting the major rôle in the production of the pus and the destructive action on the gums. Again, when the culture must travel through the mails for some time before it is incubated, it will not make as good a vaccine as would have resulted had it been incubated at once. The virulence in such cases can be raised by passing them through animals, and also it can be lowered by the same means. Furthermore, there is no way to tell which will take place until it is injected into another animal These conditions do not exist in a stock

vaccine if it is properly handled. A stock vaccine, in order to possess its greatest value, should have fresh cultures obtained from selected cases of pyorrhea, constantly added. This results in a polyvalant vaccine containing a large number of strains. For instance, the stock vaccine I am using contains cultures obtained from over 100 cases of pyorrhea.

Fig. 6.

Case U. This case (Fig. 6) is a very interesting one. This gentleman is sixty years old. He has never indulged in alcoholic liquors and has taken excellent care of himself all his life. He has been industrious and has always earned good wages, a part of which has been laid aside for years. Six years ago he developed arthritis, which gradually became so bad he was forced to give up working. At the hospital he was told that he would need to have all his teeth out before they could do anything for him. He went to one of Detroit's free dental clinics to have them extracted. After an examination the condition was diagnosed as pyorrhea. He was unable to close his hands any further than is shown in Fig 7. He could not straighten his arm out or bend it to the shoulder. His knees were so bad that he could not get to the office at times. He had a constant temperature of from 99.2 to 100.7. He often told me that he felt like jumping in the river and ending it all. Cultures were taken from every pocket and separate cultures raised. Fifteen cultures were

taken and two plants made from each culture. An examination of the cultures showed streptococcus pyogenes and staphylococcus albus. He was given an injection of stock vaccine, ½ cc., containing the following: Streptococcus pyogenes, 20,000,000; staphylococcus albus, 100,000,000, and pneumococcus, 20,000,000 per ½ cc. The next day he did not feel

Fig. 7.

Fig. 8.

as well, having a temperature of 101. That was due to the reaction from the vaccine. On the following day he said he felt better than he had for many months. His temperature was normal. Four days later he was given another injection. No reaction followed this injection. This was followed by a decided drop in the flow of pus. The dose was then increased to one cc. and an injection given every five days. Three days after the fourth injection he said he felt improved and could walk much better and had little pain. I saw him four days after he had received his sixth injection. He had control of all his limbs. He could close his

hand, as in Fig. 8, straighten his arm out and touch his shoulder with his hands, something he had not been able to do in years. He was not able to dress himself before he was relieved of pyorrhea. After treatment he returned to work and has worked steadily ever since. He has gained 5½ pounds. Now let's study this case. A general infection following pyorrhea. A new focus of infection had developed from the infection in the gum tissue and had this case been successfully treated by local means the new focus of infection would have remained. There is another point to consider. Pure cultures of streptococcus pyogenes were obtained from this gentleman's blood. His temperature came from that source. Now, what chance was there to get any benefits from local treatment alone when even the blood was carrying the bacteria into the pockets?

Oral Sepsis as Related to Systemic Disease.

W. H. Strietmann, M.D., Oakland, California.

The term "oral sepsis" and the recognition of this condition as a clinical entity is, I believe, to be accredited to William Hunter, of England, whose early recognition of the condition and its association with general debility and constant dyspepsia marks the beginning of the study of a subject which within the last decade has assumed gigantic proportions. Used by him to designate a condition related only to the teeth, it has since come into general use by the medical fraternity and includes as well, sepsis or infection originating in the tonsils or elsewhere in the oral cavity. In our own country much of the pioneer work of educating the medical profession as well as the dental fraternity, and the laity to a recognition and understanding of the importance of this subject has emanated from Dr. M. H. Fletcher, of Cincinnati, Ohio. The subject to-day is occupying the medical profession to such an extent that hardly an issue of a medical journal appears, but one may find an article dealing with it at least indirectly, and yet I am sorry to say that the great majority of both professions are far from recognizing its importance.

I realize that what I shall have to say may be received with much honest doubt and perhaps considerable antagonism, but I trust that you will weigh the evidence thoroughly, and in the future study these cases conjointly with the physician with a view to determining for yourselves from personal experience whether or not one is justified in such conclusions as I shall draw.

Systemic Infections of Local Origin.

For many years it has been known that systemic disease of certain types result from infections which were originally and primarily localized to a certain definite circumscribed focus of infection. Thus I might call to your attention an infection such as we meet in a carbuncle. Here the focus is primarily localized, but before long it extends and I have no doubt that all of you have heard of cases in which the individual so afflicted has finally succumbed to general septicemia, or as it is com-

monly known, "blood-poisoning." You have also no doubt heard of such cases of blood-poisoning following a trivial accident such as a cut in the finger which became infected, or an infected abrasion of the skin.

We know medically that syphilis has a primary focus in the so-called chancre and that subsequently the infection becomes generalized and invades the entire body. Gonorrhea begins as a urethritis and may remain so—but on the other hand, it may become generalized and invade the joints of the body producing a gonorrhœal arthritis or "rheumatism," a gonorrhœal endocarditis, or even a septicæmia which may prove rapidly fatal. I wonder also, if it has not come to your ears at some time or other that so-and-so died of blood-poisoning following the extraction of an ulcerated tooth?

In other words it means that before a patient can be the victim of a generalized infection, the infective organism must have gained admission to his general system through some primary focus or port of entry. And it would not be unreasonable to suppose that teeth and the structures in which they are imbedded may sometimes be held responsible as being the site of the primary focus. That such is really the case and not merely a generalization based on possibility we have now ample proof to demonstrate.

Rosenow's Experiments and Findings.

E. C. Rosenow of Chicago, has for some years been conducting a series of experiments which can leave no room for doubt as to the culpability of teeth and tonsils (oral sepsis) in the production of such systemic diseases as articular and muscular rheumatism, endocarditis, streptococcæmia and other allied conditions, and in order to more fully understand the subject, I shall briefly review his work and conclusions.

Starting with a certain form of streptococci, Rosenow was able, by varying the cultural conditions under which he grew these organisms, to transform the original type into other types of streptococci which we have been accustomed to look upon as distinctly different from one another, in their biologic, serologic, and clinical characteristics. Not only was he able to produce different forms of streptococci but he further changed streptococci into the diplococci of pneumonia and vice versa. The essential cultural factor which he employed in bringing about these changes was a variation in the degree of oxygen tension.

Variations in the degree of oxygen tension are more or less difficult to obtain by laboratory methods. On the other hand in nature we could ask for nothing better than the oral cavity when it becomes diseased.

Thus tonsils when infected become edematous and congested in some areas; scarred, fibrous and contracted with little blood in others, so that they are well supplied with oxygen through the blood stream in some portions and very poorly supplied in others. The crypts themselves upon their surface and in their depths offer the same variability in degree of oxygen.

In pyorrhœa there is beside the endamebic disease demonstrated by Bass an associated infection with pus forming organisms, mostly streptococcic in type, which are commonly present in all mouths. This infection begins around the gingival margin and is probably not very dangerous as regards systemic diseases as long as it remains on the surface. The process extends, however, to the deeper structures, and Bass has demonstrated that the endamebæ themselves actually pick up and carry micro-organisms into the deeper structures.

Here the only oxygen obtainable is that in the tissues brought there by the blood stream. If the tissue be infected, it is soon inflamed and edematous; it resists further invasion very feebly, and the bacteria multiply. Edema interferes with circulation and interference with circulation increases edema, and what was once an ærobic culture of an organism now goes through various modifications in its cultural environment and the organism assumes different pathogenic properties. They gain entrance into the blood stream and finally, depending upon their particular affinity for certain structures find lodgment in a small capillary loop and systemic disease has its beginning.

What may this systemic disease be? Rosenow's early work was confined to endocarditis or infection of the heart valves, and articular and muscular rheumatism. He found that cultures from tonsils or infected teeth, blind abscesses, etc., from an individual suffering from these diseases when injected into animals would produce similar lesions. He isolated from joints and muscles organisms which when injected into animals produced again the same disease. From pus derived from tonsils he found a mixture of types of organisms which produced mixed rheumatic and endocarditic changes. He showed further that these diseases were embolic in origin, that is, that a clump of organisms became lodged in a capillary loop, which was too small to admit of its passage and located in a tissue for which the given organism possessed a particular affinity. If this was in a heart valve, an endocarditis resulted; if in the terdinous end of a muscle, a muscular rheumatism developed; if in the synovial membrane of a joint, an articular rheumatism was the sequel. As might well have been supposed the list of infectious embolic disturbances has since grown and depending upon the lodgment of the bacterial

embolus, we may have the pneumonias, nephritis, choleystitis, appendicitis, etc.

Findings of Other Investigators.

R. T. Woodyatt has called attention to the frequency with which exophthalmic goitre is associated with infected mouths, and Rosenow has in a number of such cases isolated a streptococcus from the thyroid gland which, when injected into animals, causes a hyperthyroidism to develop. Woodyatt has also collected a number of cases of glycosuria in which infections of the mouth were present and the glycosurias disappeared after the infected teeth or tonsils were removed. Wm. B. Wherry of Cincinnati, has studied a number of cases of infected mouths and has found that there are apparently periodic discharges of organisms into the blood-stream without any systemic disease.

This latter phenomenon of the periodic sowing of organisms into the general circulation probably explains the cause back of a case of paroxysmal, transient glycosuria observed by the author, which was independent of diet and disappeared entirely after the removal of a tooth which had an abscess at the root-tip revealed by the X-ray but otherwise undemonstrable by a very competent dentist.

Martin Fischer adds to the list, arterio-sclerosis which is to be looked upon as an embolic process in the minute blood vessels which supply the coats of the larger arteries of the body. It may likewise become lodged in the capillaries of the kidney and produce nephritis, and as you have been told before, during this Congress, a so-called arthritis deformans may result from invasion of both the joints proper and the tissues about the joint.

The foregoing systemic diseases may, then, result from oral sepsis and other localized infections throughout the body. For the present let us confine ourselves to such conditions when they have as their primary focus, infection about the teeth including such things as pyorrhœa and blind abscess, and consider for a moment the causative factors of such infections.

The subject of pyorrhœa has received much attention lately and what I might say about the rôle of the endamœba of Bass would be repetition of a thing which I have no doubt has been thoroughly thrashed out during this Congress. Furthermore it has no direct bearing upon the subject under discussion other than that the endamœbæ, as before mentioned, may and do carry microbic organisms into the deeper tissues and thus change the cultural conditions, which in turn alters the pathogenicity of the streptococcic group as proved by Rosenow.

Etiology of Root Abscesses.

Let us consider on the other hand the etiology of root abscesses. Here I would have you consider earnestly the causative factors spoken of by Martin H. Fischer. He calls attention to the fact primarily that teeth are living structures. All of us know that living tissue of any kind is infinitely more resistant to infection than dead tissue. Hence any procedure which would tend to interfere with the vitality of the tooth or its surrounding structures must of necessity lower resistance to infection and predispose to local disease. Under this heading we must place the use of arsenic and strong antiseptics such as phenol tricresol, etc. These substances destroy bacteria no doubt, but they destroy living tissue as well.

Then comes the process known as devitalizing a tooth. The popular conception is that this process removes the nerve from the pulp canal, but as Fischer has pointed out, it also removes the nutrient artery from the center of a tooth, which naturally results in the death of the tooth centrally, again producing a favorable ground for the growth of bacteria. With the central canal deprived of its blood supply the pericementum alone is left to nourish the tooth, a thing which at best could be but very imperfectly done, but with an existing pyorrhœa or the further dental operation of placing a crown which necessitates the grinding away of the convex sides of projecting portions of the teeth, thus destroying many living cells again, it becomes an impossibility. Further the snugly fitting crown causes a pressure necrosis of the underlying cells. Infection invariably occurs around such crowns and the primary focus of possible subsequent systemic disease is planted.

The foregoing is not intended in anyway to reflect upon the technique of the dentist, the sterilization of hands and instruments, etc., for I am firmly convinced that this precaution is becoming general among them. Likewise devitalizing may be necessary for certain dental procedures now in use, but I trust the inexhaustible ingenuity of the dental profession will soon find a way to do without this method of treatment and indeed, it is well known that dentists abhor the full gold crown as much as the physicians, but find themselves compelled to use it in order to " save a tooth."

Should All Teeth be Saved?

This brings me to the important point in the discussion of the topic at hand. Is it wise always to attempt to "save the tooth"? About a year ago I observed a case of malignant endocarditis resulting in the death of a woman who had a number of loose teeth that were continually bathed in pus and which I considered to be the origin of her systemic disease. After her death her husband came

to me and I found a badly infected loose cuspid with two sinuses discharging through the gum above. An X-ray showed a root abscess about the size of a pea and I advised him to have it removed at once. He was called hurriedly to Denver whence I received a letter from him in which he said: "You will be glad to hear that I have found a very clever dentist here, who promises me that he can save my tooth." He did save the tooth and likewise the infection. The man has since had an articular rheumatism and found a dentist who was clever enough to extract the offending member.

I believe that I realize as well as the members of your profession the necessity of saving teeth, but I feel that there is a time when it is a crime to attempt to save teeth. And it is for the recognition of this that I beg your co-operation. The mouth is only a part of the body and yet it has been pitifully neglected by the average physician in the past. On the other hand because the primary infectious focus begins around the teeth is no good reason for the dentist to say "this tooth should not be removed; it can be saved." I have often had patients return to me with the remark that their dentists absolutely refuse to extract a given tooth announcing that it "has nothing to do with your rheumatism, etc." To such dentists I would respectfully suggest that they know nothing about it. On the other hand I am perfectly willing to admit that the medical profession know practically nothing about dentistry. To them a root abscess is in a class with an infected Fallopian tube, a mastoid full of pus or a tonsil that is septic, and the infection must be treated surgically. Of course, the whole thing resolves itself ultimately into a matter of prophylaxis. Teeth must not be allowed to get into the deplorable state in which we both so often find them. This requires education and I congratulate your profession on the magnificent work it has done in this connection by the wholesale examination of school children and the establishment of free clinics in the schools and congested districts. I envy you the power you exercise over most of your patients to make them return to you at certain intervals for examination. I have tried to do this with every patient I have seen in the last three years and I have two who realize the honesty of my purpose.

In conclusion let me ask that the two professions co-operate to the fullest to determine the result of radical removal of badly infected teeth on the one hand as contrasted with the conservative treatment of such cases on the other hand. Let us try to determine when you may save us from losing a tooth and when losing a tooth may save us perhaps from a fatal disease.

References.

E. C. Rosenow: Jour. Infest. Dis., 7,410 (1910); Ibid., 14, 1, (1914).

E. C. Bass:

Martin H. Fischer: Edema and Nephritis, second edition, New York, 1915.

Frank Billings: Arch. Int. Med., 4, 409 (1909); Ibid., 9, 484 (1912); Journ. Am. Med. Ass'n., 61, 819 (1913); Ill. Med. Journ., 25, 11 (1914); Journ. Am. Med. Ass'n., 63, 889 (1914).

E. R. LeCount and Leila Jackson: Journ. Infect. Dis., 15, 389 (1914).

R. T. Woodyatt: quoted by Martin H. Fischer, Lancet Clinic, 6, 129 (1915).

E. C. Rosenow: quoted by Martin H. Fischer, Lancet Clinic, 6, 129 (1915).

R. T. Woodyatt: Personal communication, Jan., 1915.

Wm. B. Wherry: quoted by Martin H. Fischer, Lancet Clinic, 6, 129 (1915).

Martin H. Fischer: Lancet Clinic, 6, 129 (1915).

T. B. Hartzell and A. T. Henrici: Journ. Am. Med. Ass'n., 64, 1,055 (1915).

W. H. Strietmann: Journ. Calif. State Med. Ass'n., March (1915).

Pathological Conditions Found in the Mouths of Some Children.

By M. Evangeline Jordon, D.D.S., Los Angeles, California.

Malnutrition is more prevalent and much more disastrous than is at present understood. That its causes and effects are matters that distinctly concern the dentist will, I hope be gathered from the history of a few cases. While these cases are extreme, they are by no means rare, and are used to emphasize the need of a better understanding of one of the results of malnutrition.

Diet and dentistry have a close relationship; but I do not know of a single dental college that has a course of lectures upon dietetics.

The subject of infant feeding with relation to oral conditions—hygiene, calcification of the teeth, malocclusion and caries—is one that must be faced by the dental profession. This has become necessary because the medical profession, which has directed infant feeding for the last half century, has been unable to gain headway against the rapid increase of dental caries. Their policy of using easily digested food, requiring little or no mastication, while possibly most excellent from their standpoint, leaves much to be desired from a dental point of view.

A perfect denture cannot be developed unless we have perfect digestion. How can this be maintained when life, beginning on a bottle, is carried along upon a diet of highly concentrated starches and sugars, and adult life is reached with no necessity or knowledge of proper mastication?*

The gratifying results that follow a change of diet and an education in "how to chew" leads one to the belief that if the present generation were educated upon the effects of diet upon the teeth the next one might have better dentures and would stand a splendid chance of escaping caries and that much-feared disease, pyorrhea.

Case No. 1. Madeline M., ten months. She was brought for treatment February 23d. The history was that she was bottle-fed and during the first three months there was severe malnutrition. Then for four months she had been very well and had gained in weight and strength. When dentition began at the

*See paper by Dr. Lawrence W. Baker, Dental Items of Interest, July, 1916.—Ed.

seventh month there was a general disturbance of the system and colic, tenderness of the joints and swollen gums, which had increased up to the time when I saw her. Examination of the mouth disclosed dark inflamed and swollen gums nearly covering the six erupted incisors, with the area over the erupting lower laterals a dark purple. The child was suffering with painful joints, particularly one of the innominates, and was also suffering from colic. It was a typical case of scurvy. The child had

Fig. 1.

Fig. 2.

been under the treatment of an osteopath for three months, but no change had been made in her diet and there had been no improvement in her condition.

I prescribed an addition of orange juice to the diet, as no fruit juice was given. Locally the mouth was to be swabbed out with boracic acid and the gums gently massaged several times a day. I saw the child in two weeks and there was great improvement. March 16th, when she made the last visit to the office, the gums were normal and nearly all tenderness of the joints had disappeared. March 19th the mother wrote me: "Baby is doing fine. Has gained one pound in two weeks and her recovery has been very rapid. Her legs are entirely over their sensitiveness and her mouth seems to be in excellent condition. She is cutting two more teeth and does not seem to suffer much distress."

Case No. 2. Barbara McG., four and one-half years old, applied for treatment May 18th. The two upper lateral and right central incisors had dead pulps with badly swollen gums (Fig. 1). She was born in a well-to-do family, of a mother who—while apparently in robust health—had suffered so severely with richitis in her own childhood that from her hips down she lacks

more than a foot of being in proper proportion. Barbara was born twenty-one months after a sister whose development has been normal. She early showed a lack of proper development which the physicians thought due to lack of recuperation on the part of the mother from the former childbirth. Barbara now has badly bowed legs, but otherwise is healthy in appearance. Last September she had a fall and an abscess appeared upon the gum over one of the incisors. In January she had

Fig. 3.

a second fall and her teeth again were abscessed. There was no caries of the teeth and the dentists consulted only opened the abscess through the gums without treating the root canals.

I drilled through the lingual surface of the teeth, gave three treatments of formocresol, and as all pus and swelling had disappeared I filled the pulp chambers with alum paste and gutta-percha.

In August the central became so loose that it was necessary to remove it. Fig. 2 shows two views of the tooth after exfoliation.

Case No. 3. Carol S., age four; eight-months' baby. The child is large and fleshy, but she inherits a tendency to tuberculosis. She had indications of anæmia. Apparently there was a lack of co-ordination of the muscles in walking, although later I discovered that an abnormal condition of the mind of the mother had prevented the child's development in that respect. She told me that there was a history of richitis and malnutrition, but just how much of this was dependable I am unable to determine. At least the child could not walk alone nor climb into the chair when she came to me on her fourth birthday. Between her second and third year she had

a fall which resulted in abscesses of the upper central incisors (Fig. 3). Five teeth had dead or exposed pulps, and when these were treated and all other cavities filled she rapidly improved. She walks and runs about very actively, just as do other children of her age.

Case No. 4. Albert B., age six. The history is that at six months he had chicken-pox. Before he was two he had an operation for the removal of his tonsils and adenoids. About that time he began to suffer from croup and continued

Fig. 4.

Fig. 5.

to do so for over a year. Before he was three he had whooping-cough, which was immediately followed by measles.

He shows the results of malnutrition. Examination showed that both the lower first molars had abscesses of many months' standing (Figs. 4 and 5). These had been unsuccessfully treated, and apparently Nature was pushing up the first bicuspids to occupy the space where the molars should be exfoliated. A few treatments healed the abscesses and and the bicuspids stopped their advance.

Case No. 5. Rose M., seven years, undersized, weighing only 36.8 pounds. Came for treatment in January. The last of February five teeth with dead pulps and a number of cavities had been treated and filled, but the gums remained swollen and bleeding. Pus could be pressed from under their margins. All loose teeth whose edges were rough from root resorption were extracted. As the condition of the gums did not improve she was sent to a physician for a physical survey. The blood count and urine were normal. The diagnosis was malnutrition, due to improper food. She was then put upon a diet and gained in weight, but there was little improvement in the condition of the gums. May 18th, had a microscopic examination made, and amœbæ buccalis were found under the margins of the

gums. One-eighth of a grain of emetin was given hypodermically in the deep muscles. May 20th, one-quarter of a grain was given, and although on the 26th no amœbæ were found, a third dose of one-quarter grain was given. July 7th three slides were made, but no amœbæ could be found, although there still was pus. August 13th she was given the Von Pirquet tuberculin test, which showed a strongly positive reaction in twenty-four hours. In forty-eight hours the reaction attained its maxi-

Fig. 6.

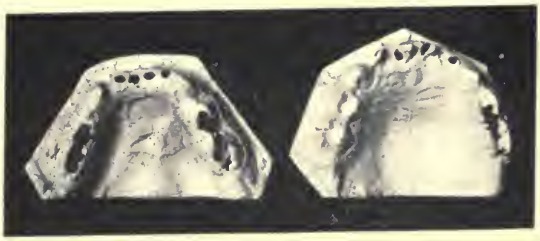

Fig. 7.

mum with marked hyperemia and some swelling around the site of inoculation. It began to fade on the fourth day, and entirely disappeared on the seventh day. The chest examination varied very slightly from normal. Heliotherapy, that is, the exposure of a considerable portion of the body to the sunshine, was recommended, and her condition was gradually improved. She had gained three pounds within six weeks and the condition of her gums is improving. There was a slight swelling and hyperemia around two or three of the teeth, but no pus at the last examination.

Case No. 6. Milbury S., five years of age. The history of the case is that he was healthy until the fifth month, when he had an almost fatal attack of pneumonia. This so delayed his development that dentition did not begin until he was a year old, and his present development is over a year below normal.

His mother attributes the early destruction of his teeth to medicines given then and at subsequent periods, but undoubtedly injudicious feeding has played an important part. The predominance of unmasticated carbo-hydrates, part in the form of candy eaten at all hours, has resulted in a mouth in which just half of the twenty teeth have lost the pulps (Figs. 6 and 7). Here we have a child where the deciduous teeth are lasting

Fig. 8.

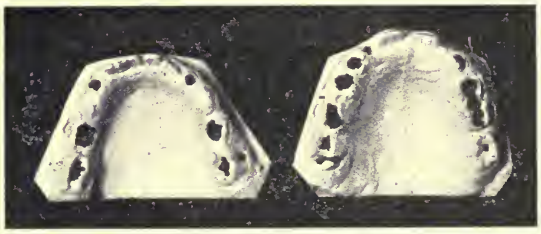

Fig. 9.

less than one-third of the time for which they were created. This patient and the one whose model I shall next show are similar in many ways.

Case No. 7. Marian McN., nearly seven. Here is a case where a child under seven years has a deciduous denture nearly worthless for mastication, and the permanent teeth, which have been in position for only a few months, are rapidly breaking down (Figs. 8 and 9). In spite of all we can do with prophylaxis, cauterizing with silver nitrate and alkaline mouth washes, the lower left permanent central is disintegrating on all surfaces, no doubt due to acid erosion. Conditions in her mouth point to the conclusion that she had never masticated her food, and as you can see from the model her masticating surface, even if she could be taught the proper exercise of

that very necessary and useful function, is very much reduced and will remain so for the next five years. She is a delicate child, seldom free from a cold.

One peculiar coincidence is that both of these children broke an arm last summer. Three other patients of mine, whose mouths were in a pathological condition, suffered from the same accident, and I have been wondering if there could be any relation between the malnutrition and a faulty calcium metabolism, or are such children more awkward because of a lack of co-ordination due to these pathological conditions of the mouth?

Just along this line of thought I have two cases recorded where the children had a habit of stumbling and falling down when their teeth were aching. Another child of three was not only awkward about walking, but appeared almost idiotic. After nine pulp chambers had been treated and filled his nurse reported a great improvement in his motor activity, in his speech and in his mental development.

Case No. 8. Clifford W., aged twelve, was referred to me for examination in July, 1912. His appearance indicated malnutrition and mental sluggishness. His speech was difficult to understand and he did not give logical replies to the questions I asked. His oral cavity was extremely pathological; scarcely a tooth was without two or three deep cavities. One of the first permanent molars was badly broken down, having a chronic abscess with a large fistula. His mother said that his health was so poor that she did not expect to raise him, so only wanted enough work done to make him comfortable. He had the peculiarity, common to infants and feeble-minded children, of swallowing water used to rinse the mouth, and no explanations nor arguments could induce him to spit it out. I had him lean over the bowl so the water would drain into it, and in that way was able to rinse some of the sordes from around his teeth. Under the circumstances, recognizing that the blood stream would be carrying a heavy load of toxines with a corresponding lack of recuperative power in the tissues, I advised the removal of the first molar and sent him to an extractor.

In October his mother brought him back and said that there had been so much improvement in his health that they had decided to have all of the teeth put into good repair. He was very difficult to work with, on account of being so much afraid of every move made by the operator. His teeth and tongue were still heavily coated and the saliva was thick and ropy. His peculiarity about swallowing and his fear that his mouth would be burned by some medicine hindered the work. Three upper in-

cisors were found to have blind abscesses. Within a few weeks after I had begun treating them he surprised me one day by asking a logical question with regard to the flow of water in the cuspidor in a distinct voice, showing that his brain was at work in a normal way. From that time his mental and articular improvement were continuous. His mother has given the oral cavity extra good daily care, and if you were to meet him you would consider him a bright, normal boy.

Importance of Mastication.

Mastication is the salvation of the teeth, but it has gone out of fashion during the last few years, because the present popular foods are of a nature to be easily swallowed.

It is as much the duty of the dentist of to-day to educate the people to masticate as it is to repair their teeth.

After reciting a long list of the evils of not masticating, Sim Wallace says: "Yet, in spite of these terrible facts, the nutritious pap system of feeding children is gaily advocated by intelligent and responsible physicians." This brings to mind a large family of delicate children who occasionally visit my office. These children are fed two meals of mush and milk every day, and while having naturally strong yellow teeth, because of this diet, and the lack of use, each child has teeth that are white and chalky and the fissures in the permanent molars are carious before the teeth are fully erupted. All that these children needed was for each child to be given some hard food as soon as it had a tooth with which to gnaw. Unfortunately, the mother thinks that as she was brought up on mush her children should be, also, blind to the fact that her own teeth testify to the evil effects of such a soft diet.

Another family had even worse mouths, due to the same ignorance of the results of soft foods, but after repair and careful instruction in the art of mastication, their health has improved and there has been no further trouble with their teeth. As a proof of the value of mastication, many of my patients, who have begun life handicapped with a system weakened through inheritance, have, because of early education and a diet of hard foods, very perfect teeth with well-formed jaws.

Add mastication to oral hygiene and we take a long stride in lifting the race to a higher plane.

Quoting Dr. Osler in his address to the students at the Royal Dental Hospital, "You have just one gospel to preach, and you have got to preach it early and you have got to preach it late, in season and out of season. It is the gospel of cleanliness of the mouth, cleanliness of the teeth, cleanliness of the throat." And to this let us add, the gospel of mastication.

(I am indebted to Dr. La Touche and the University of Southern California for help in preparing my radiographs.)

The Etiology of Dental Abscess: Acute and Chronic

Recent Studies by THOMAS B. HARTZELL, M.D., D.M.D., Research Professor of Mouth Infections, School of Medicine, Professor of Oral Surgery, College of Dentistry and ARTHUR T. HENRICI, Instructor Bacteriology, School of Medicine.

Acute Dental Abscess

The acute dental abscess is the type which begins with tenderness to pressure on occlusion or percussion of the tooth in question. This tenderness to pressure is soon followed by pain which steadily increases as pus formation proceeds and is accompanied by swelling in its later stages, which swelling slowly increases as pus formation proceeds until the tension of the accumulated fluid is relieved by the development of a fistula or incision.

The examination and study of a series of eight recent cases of the above type by Henrici show the predominant organism to have been the staphylococcus. The case histories show the avenue of infection to have been the root canals in six of the eight cases.

Chronic Dental Abscess

The so-called chronic dental abscess is the type which causes slow resorption about the root ends of teeth. It is generally painless, slow in development, and produces a cavity in the bone, which cavity is generally symmetrical in form and is lined with a connective tissue sac, the inner surface of which shows pus and epithelial cells and contains a straw colored fluid. This type is not an abscess but rather an infectious granulomatous cyst.

Appearance of Cavity In the Bone

In the bone, it presents an interesting condition showing two types of inflammation within a narrow zone of a cross section of its periphery as follows—a zone of rarefying inflammation which slowly increases the size of the cystic cavity. Immediately inside of this zone of rarefying inflammation, we find a condensing osteitis so that the cystic cavity, when emptied of its contents, presents a white smooth surface closely resembling the inner surface of a tooth socket from which a healthy tooth has been removed.

The manner of the development and growth of this cyst, to a great degree explains why it is that this type of infection does not cause more

harm in the way of metastatic infection than it does, inclosed as it is by a coat of epithelial and pus cells and connective tissue sac, a zone of condensing osteitis and outside of that a rather broad zone of rarefying inflammation all of which tends to limit the spread of the infectious material within the cyst sac.

Organisms found in Granulomata

The predominant organism, as shown by Henrici by culture, in these cystic granulomata is the streptococcus viridans. Recent articles in both medical and dental literature suggest that these infections are blood borne and occur in the sockets of teeth as a secondary result of constitutional infection, locating about tooth root ends, because the pulpless tooth presents an alleged area of low resistance. That infection carried in by the blood and lymphatic stream occurs is reasonable, but that such infection originates in the blood stream or in distant parts of the body and is conveyed to the dental tract is not borne out by an examination of the facts as shown by a study of the tissues involved and a study of the infectious material growing in the dental tract.

Mode of Entrance of Bacteria

First; an examination of tooth surfaces and saliva reveals the fact that both streptococci and staphylococci are always present in vast numbers.

Second; root canal surgery and treatment is seldom carried out under aseptic conditions. Recent studies by Best accentuate the well-known fact that cotton, broaches, and most utensils about the dental cabinet produce growth, indicating that the operation is carried out in average root canals under conditions that invite infection.

Third; the gingival crevice is always open and subject to infection from tooth surfaces and saliva.

Fourth; the most direct route to the socket tip is the root canal when open, and it is rarely successfully blocked to the entrance of infection when filled.

Fifth; the venae and peri-vascular lymph spaces can, from the bottom of the gingival crevice which is open, carry infection to the peridental membrane and socket apex, which movement of infectious material is aided by the enormous force of mastication.

Sixth; we have recent records of 150 absolutely sound teeth whose pulps were destroyed by peridental infections.

Seventh; we have also a series of cases wherein sound teeth have presented infection of the pulp with absolutely no opening into pulps

except the apical foramen, showing that the previous devitalization of the tooth is not the only factor in abscess formation or pulp death.

Eighth; we find the peridental tissues always produce viridans growth, it being necessary to sterilize by iodin, dry pack, and cauterize gingival crevices to obtain roots of vital teeth that will be free from infection when planted in sterile media, which is further evidence that the tissues about the teeth afford the nearest source of infection of the socket tip.

Ninth; Davis in one hundred and fifteen tonsil examinations shows 90% contained hæmolytic growth. Henrici has been unable to find a single instance of hæmolysis by the streptococci, from two hundred and eighty dental abscesses. If the streptococcus in the dental cyst came from the tonsil or other source by the blood stream, it should be hæmolytic.

Tenth; the imperfections of the gingival crevice can be easily demonstrated by the use of oxygen under compression delivered half way into th crevice from a blunt-nosed needle, which experiment evidences the entrance of the oxygen into the tissues by the physical movement of the tissues. Where oxygen will penetrate, bacteria may also enter.

Eleventh; pyorrhea, ulceration of the gingival crevice, heavily infected tooth surface, and septic root canal procedures are the fruitful sources of both acute and chronic dental infections.

The responsibility for the prevention of both conditions in clearly the dentist's and demands the constant use of the X-ray, absolute asepsis in root canal surgery, root filling that protects the individual from infection, and last and most important, the prevention and cure of all ulcerating conditions about the teeth.

Differentiation of the Radiographical Appearance of Normal and Abnormal Tissues as an aid to Dental Diagnosis.

By Dr. Noboru Teruuchi, Tokyo Dental College.

More than ten years have elapsed since radiographs were introduced as an aid to diagnosis for dental diseases. Many important and interesting reports and papers have been published describing the making and reading of radiographs. It must be admitted, however, that those communications have been limited generally to the making of radiographs or to the comparison between the symptoms of diseases and radiographs, and have never touched the problem of the substantial changes of the tissues which are submitted to diagnosis and they have never discussed the relation between these changes and radiographs. In other words (1) How the changes of the tissues caused the varied appearances in radiographs; (2) What is the region in which the change occurs? (3) What is the extent of the change?

In fact, we scarcely find published any experimental information with regard to the study of these three questions. Taking these into account, I have paid special attention to the radiographic appearances and have obtained some noteworthy results which will be reported in the following pages, in company with a comparative study between the radiographic diagnosis in our laboratory, the clinical symptoms and the result of operative research; and on the other hand by making radiographs on dead bodies, which the writer dissected or in which he made pathological regions artificially. The following is the report of our research for solving the three questions by means of the processes above enumerated:

Recently a brief paper appeared in the "*Dental Cosmos,*" for May, 1915, being the report of the study of Howard R. Raper, who seems to have had the same purpose as myself. In that report, he declared, "Men will depend upon them (radiographs) too much, be disappointed, and then condemn them as altogether unreliable."

His assertion seems reasonable, and the writer also from clinical practice is so far of the same opinion. It is my great regret that I have had no opportunity of seeing the reports of Dr. Raper's experimental re-

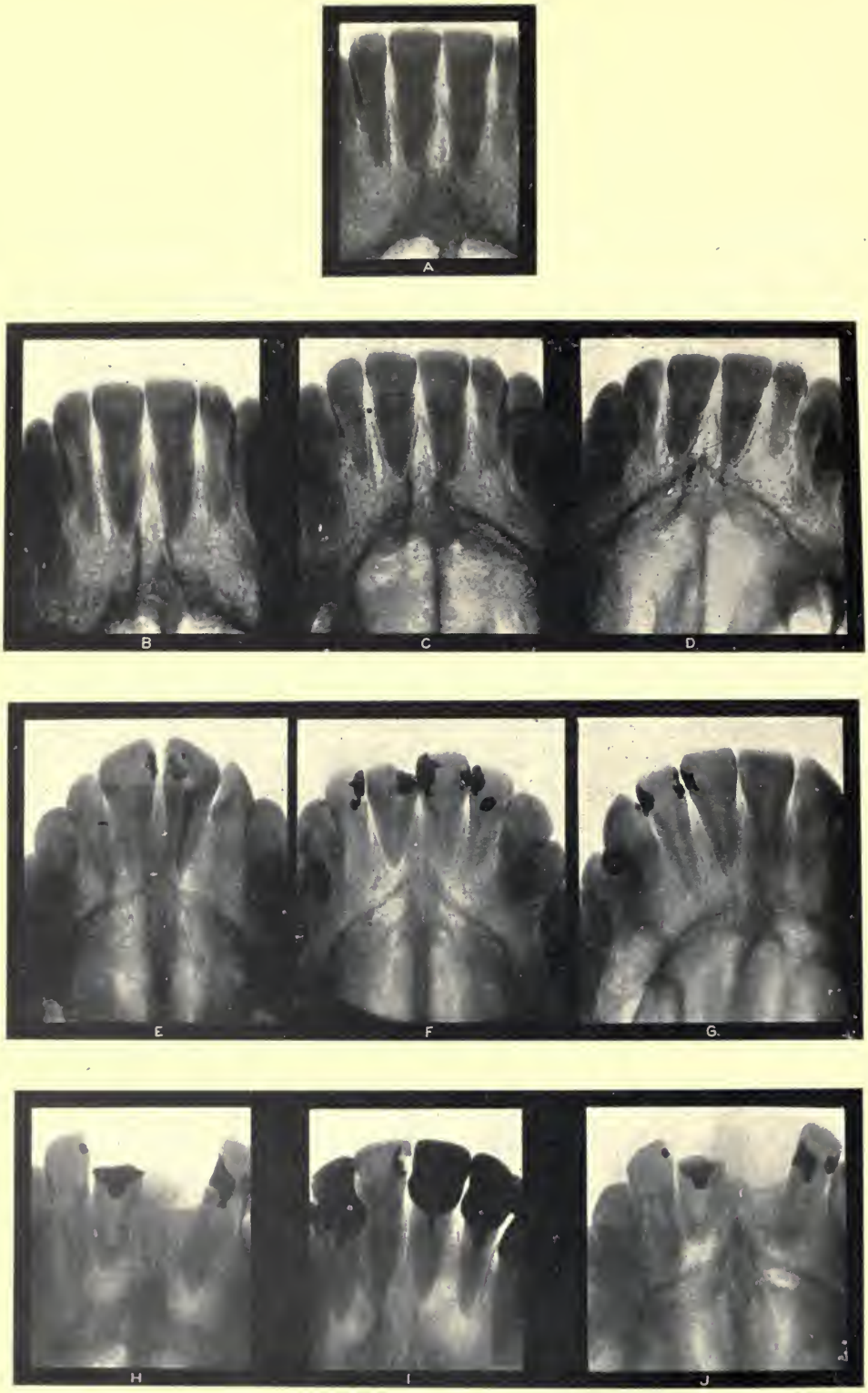

Fig. 1.

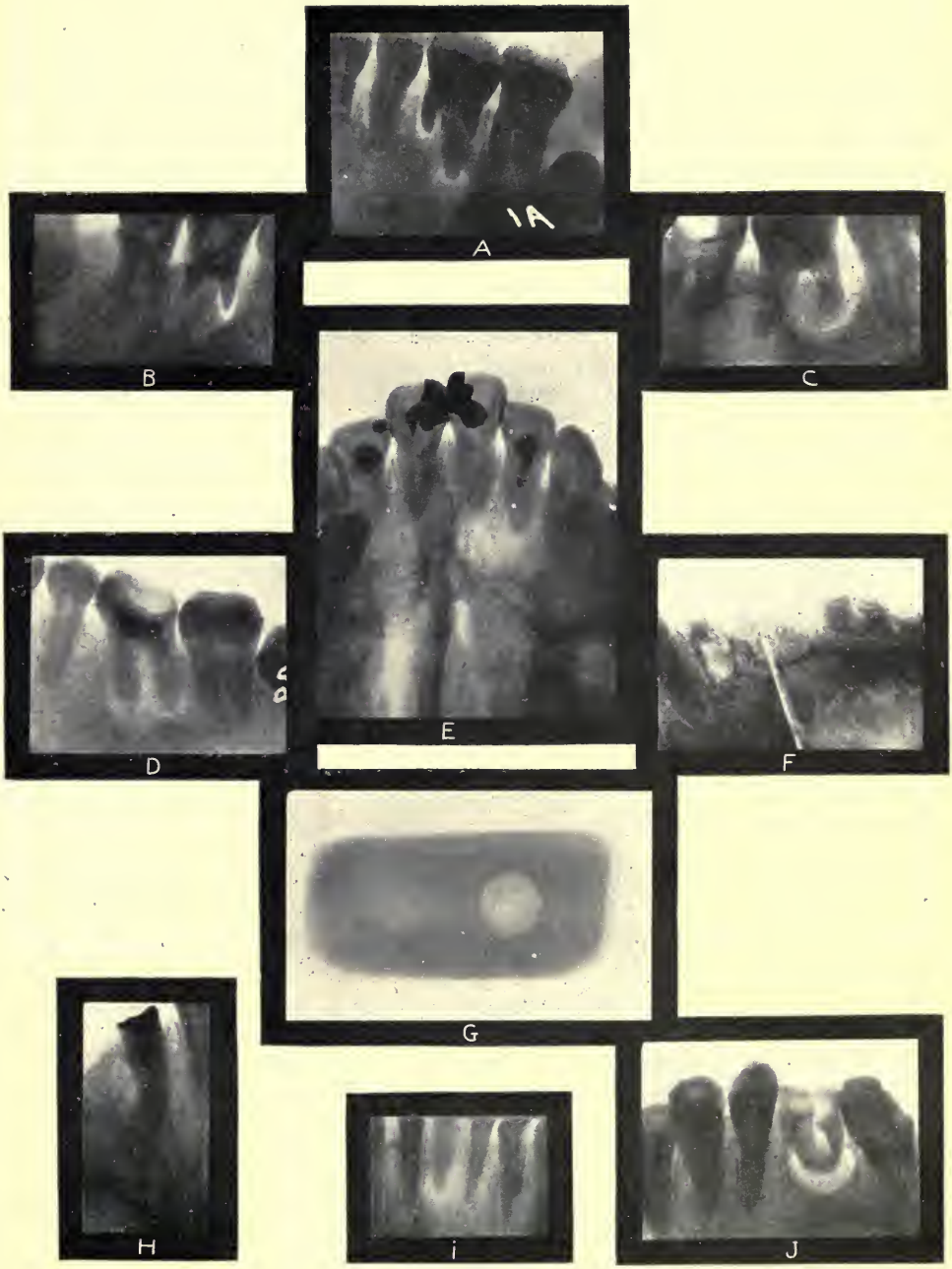

Fig. 2.

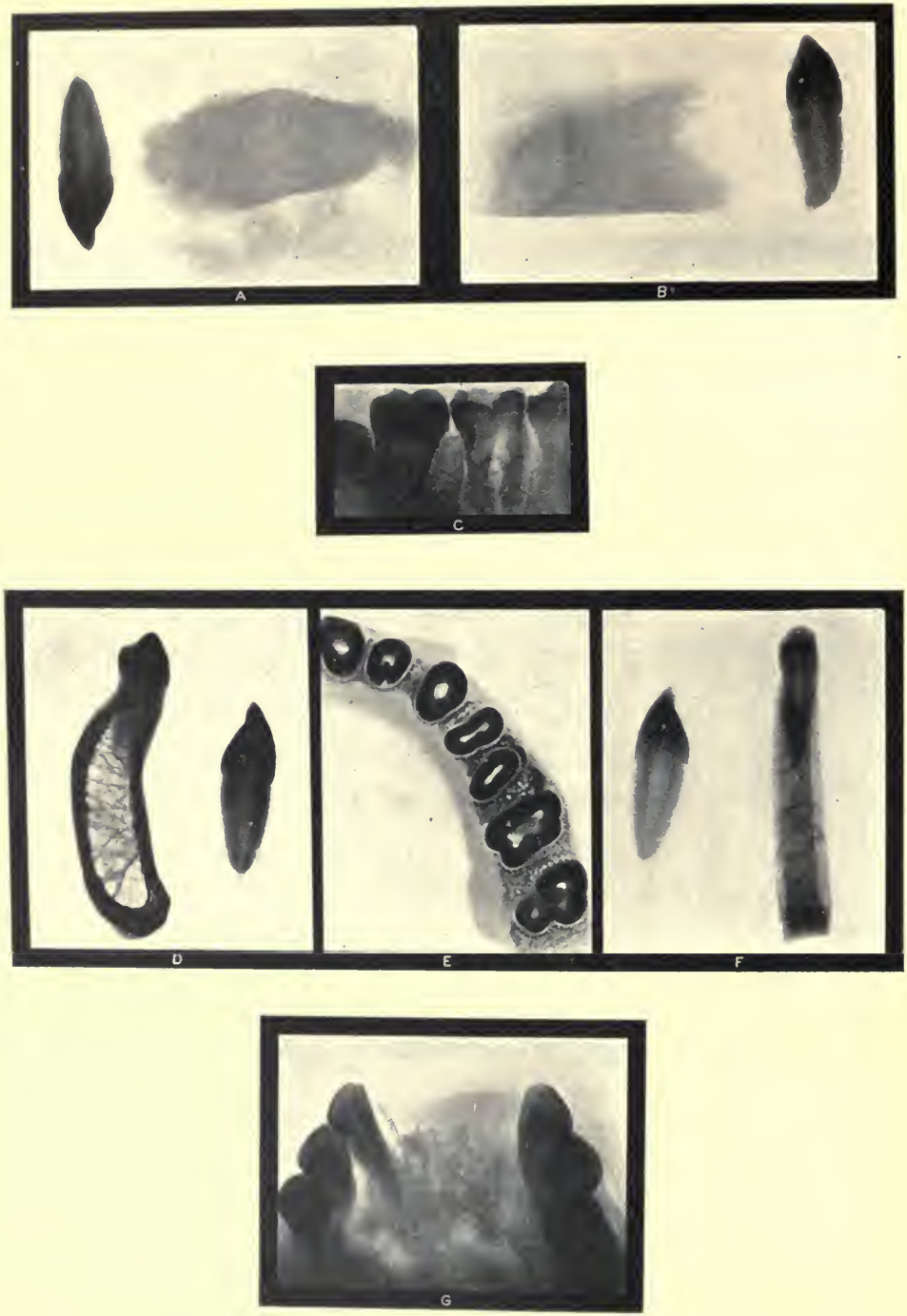

Fig. 3.

Fig. 4.

search. Thus I do not know to what degree he believes it is safe to rest a diagnosis upon a radiographic examination. I shall hereby make a brief report on my own research for the purpose.

How Can We Avoid Misinterpretations.

To make the correct interpretations, we should be familiar with the appearance of normal tissues. Next, we ought to know every situation in which we are apt to have misinterpretations, to give a correct diagnosis in each case; and thirdly, we ought to understand the direction in which we should make a special exposure and it should be made with much care.

Appearance of Normal Tissues.

That which appears in the radiograph is the dimension and radiopacity of the region. There will be difference according to the following conditions: 1. Position of film; 2. Position of tube; 3. Power of penetration of X-ray.

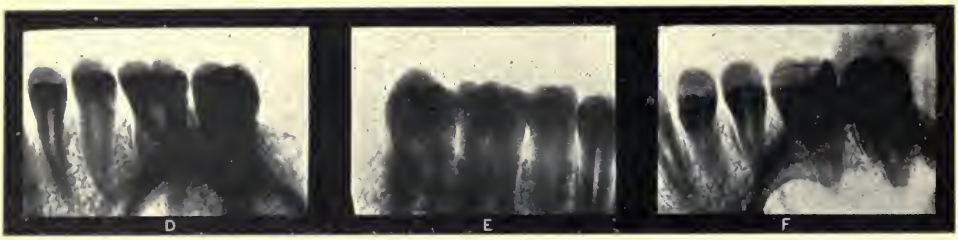

Fig. 5.

Fig. 6a.

Fig. 6b.

The appearances in the radiographs will vary in accordance with the conditions. Furthermore, there may be many differences due to the change of the position of tube; the change may be to the right or left, to the lower position or to the higher position. The change also will be related to the distance. As you see from this explanation the radiographs of a normal tissue will be innumerable if the three conditions shift in various ways.

Fig. 7.

The writer insists that it is necessary to determine beforehand these three conditions and re'y only upon a radiograph which has been made by a definite process. The definite conditions for making the radiograph must be determined in advance, to be available for each varied situation.

The writer determined the following conditions through varied study in three hundred cases. The appearances obtained by this principle may be eleven in variety, by which we can diagnose a thousand symptoms quite simply.

Method of Holding Film in the Mouth for Diagnosis of Teeth.

Position of the Film.

We should make a radiograph by placing the film as close as possible to the tooth, in a position as parallel as it may be to the axis of the tooth. The radiograph should contain to approximating teeth, at least. To fulfil these conditions, the film is limited to be 4 x 3 cm. in size. Such a small film as this aids us to avoid misinterpretation.

Position of the Tube.

The distance between the tube and the film should be 50 cm.; (NOTE BY THE EDITOR. At this point, through some unaccountable circumstance the editor finds that a page of manuscript is missing. From the subsequent context the editor surmises that the distinguished

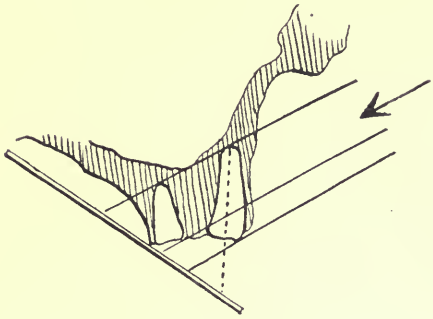

Diagram A.

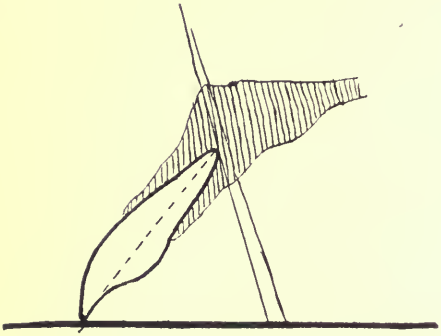

Diagram B1.

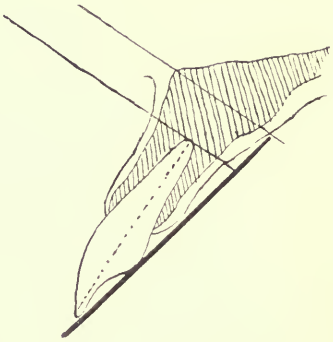

Diagram B2.

author points out the danger of resting a diagnosis upon a single radiograph, taken in routine fashion. He also evidently discusses stereoscopic radiography, admits its possibilities, but doubts its general adoption by the dental profession as being too complicated, and then makes a plea for a method which he has devised and which he terms double radiography, which he again adequately describes in his conclusions at the end of his excellent thesis. If the editor has wrongly guessed at the lost part of the manuscript he hopes for the pardon of Dr. Teruuchi. Unfortunately the discovery was made too late to communicate with the author prior to publication. After quoting from Dr. Raper in regard to possibilities of misinterpretation of radiographs the author continues:)

The writer should like to add the following to those of Dr. Raper's.

1. To mistake the lingual root of the upper molar having three roots,

Fig. 8.

for the cementum of the mesial or distal root. Fig. 5a and b, cannot be mistaken but Fig. 5c is easily. (See Diagram A.) A correct diagnosis can be had by the double radiograph.

2. To mistake the pathological change arisen symmetrically at the upper incisors for the light area by the region of the palatal process (Fig. 1j). Fig. 1h and i are taken by the double radiograph to diagnose correctly this symptom (Diagrams, B1 and B2).

3. To find it difficult to determine between deep carious cavities and the resorption of the alveolar process (Fig. 3c). We can determine by the double radiograph.

4. To mistake that which appears like the enlargement of the *foramen apicale* due to the distortion of the root, for the enlargement of the *foramen apicale*. This can be determined by means of double radiographs, but it is much safer to diagnose by the method which will be explained in the "examination of pericementum."

5. To mistake for necrosis in the mandible in the region of the lower incisors and bicuspid the light area which can be seen in the normal mandible. We are not deceived in Fig. 4, but become suspicious in Figs. 6 and 7. In these radiographs taken from the bone alone there presents a light area, which is due to the thinness of the bone tissue. In the case of living body, we very frequently become suspicious, as the muscular tissues are specially thin at this part, so that other parts appear dark.

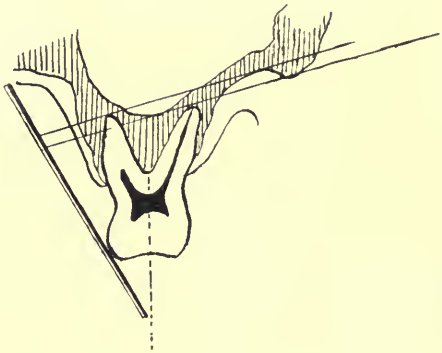

Diagram C.

This suspicion is aroused more frequently when the tube is too soft. In that case it is quite difficult to make a correct diagnosis. The typical appearance of necrosis as seen in Fig. 8, is typical in presenting that of necrosis.

6. Sometimes there presents a very dark area in the net-like tissues in the spongy bone of the corpus mandibulæ (Figs. 9b, 10, 11). When there is clinical reason for expecting some pathological change in the part, the dark area is quite suspicious, as a matter of course, but ordinarily these dark areas exist in normal mandibles.

Deformity of Bone and Tooth.

Though it is quite safe for us to diagnose by the above mentioned methods, yet there may arise some difficult cases with regard to the surrounding conditions which present some suspicious appearance of deformity.

1. We may have difficulty in the diagnosis of the molar root for a person who has a prominent zigoma and a low palatal vault. Though we always take special care in these cases, yet mistakes often arise, due to the appearance of the dark area (Fig. 5d, e, f, and Diagram C). In that case, we should prefer a smaller film and radiate obliquely. Curving the film should be avoided. We should expect changes of the appearance of

the root to be caused by the oblique direction of the ray (Fig. 5g, h, i, j, k).

2. Usually there is no appearance of this dark area in the mandible as a whole, but in some peculiar circumstance it appears in the region of the third molar (Fig. 12a). In ordinary cases there is no fear of mistakes, but we will sometimes make an error in such cases as tumor, fibroma, or dental cyst (Figs. 12b and 13b). To avoid this danger, we should make the patient stretch out his neck and not open his mouth, and then make radiograph from the front. A perfect diagnosis can be made by double radiographs.

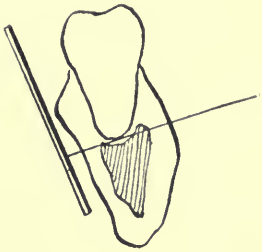

Diagram D.

3. When we try to diagnose a pathological change in the roots of the anterior teeth, by making the patient bite the film (in cases where the arch of the upper teeth is large and the incisors stand at a less angle than 60° to the occlusal plane), we are frequently unable to diagnose a slight pathological change of the root of the central incisor, because it is obscured by the dark area of the inferior margin of the pyriform aperture, or else the diagnosis may be uncertain (Fig. 1e, f, g). When we change the angle to avoid this disadvantage, the teeth will prolong more than the natural size. The writer recommends the use of the small film, 3 x 4 cm.; such a film will lie close to the palate (Fig. 1a). By using such a small film, we can even make a perfect radiograph of a tooth in the nasal cavity.

4. In the diagnosis of pathological change at the apex of the third molar, we feel frequently embarrassed by the *linea obliqua interna* and *externa* (Diagram D and Figs. 21a, b, and also see 14). To be free from this disadavantge, we should prolong the time of exposure (it is wrong to harden the tube). Make radiographs perpendicularly to the plane of the mandible.

The Possibility of Diagnosis.

We are apt too frequently to diagnose a case, quite contrary to the result of the symptomatic diagnosis and operative examination, though every possible care be taken in making and reading the radiographs. How shall we explain this fact?

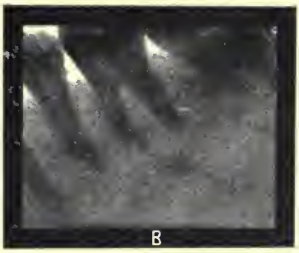

Fig. 9.

Fig. 10.

Fig. 11.

The gradation in the radiograph results from the resistance of the tissues due to thickness and density. The diseases of the teeth and mandibles show in radiographs solely owing to the changes of density. The deep shadows show cementoma, osteoma, pulp nodules and tartar; while other diseases are diagnosed, as density is decreased. This loss of density (whether it may be physical or chemical) is caused by the diminution or disappearance of calcium salt. When a part of the mandible is decalcified, it shows in the radiographs the similar appearance to that that is taken off. From this reason, the fact that tumor (Fig. 2a), granuloma (Fig. 2a), cyst (Fig. 2c), necrosis (Fig.3g), dental caries (Fig. 3c) are read by light areas, is explained as the diminution or disappearance of calcium salt at the part. When the teeth and mandible are decalcified and radiographed, the gradation will be seen in accordance with the thickness of the part. This experiment shows that the density of every part is made uniform by the decalcification. The writer made a study of

the decalcified teeth and mandibles. He perforated them in one part and inserted granulation tissue; he then noticed that they did not show any increase in density sufficient to be seen in the radiographs.

Fig. 3a shows a decalcified piece of the maxilla which is radiographed in the mesio-distal direction (see the uncalcified canine tooth in contrast);

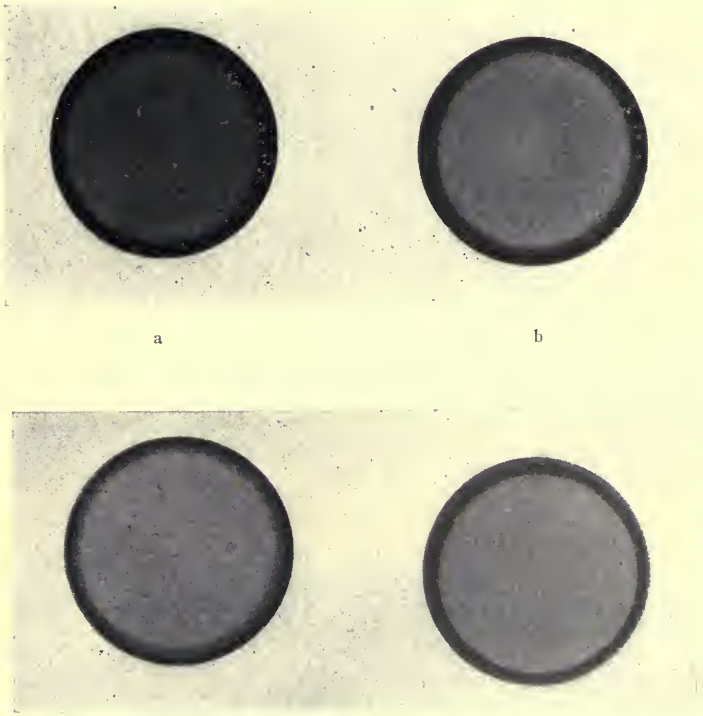

Fig. 12.

and the Fig. 3b is that which is radiographed in the bucco-lingual direction. Both show simply the gradation in proportion to the thickness, and the difference of density between the compact bone, sponge bone, and teeth is not shown at all. When these are compared to the uncalcified (Fig. 3d shows the mesio-distal appearance of the region of the lower first bicuspid; f, bucco-lingual appearance), the difference is vividly noticed.

And now can we read radiographs for differences between alveolar abscess, granuloma, and radicular cyst? If possible, the advantage would be marvelous. Francis le Roy Satterlee says, "If the abscess cavity con-

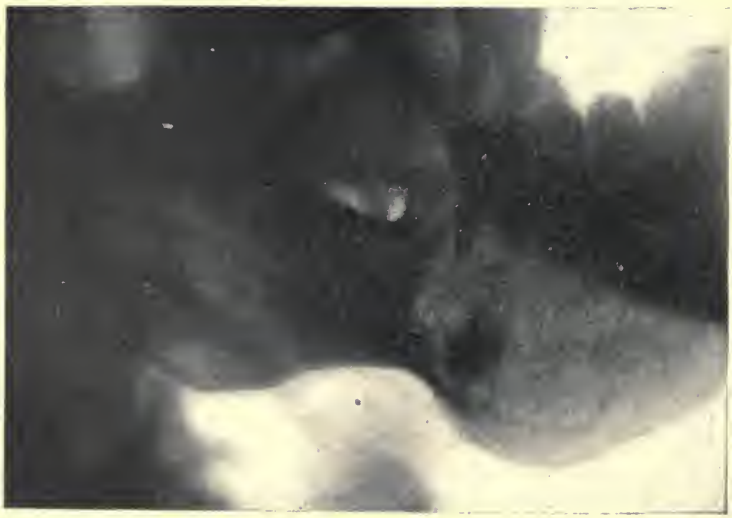

Fig. 12a.

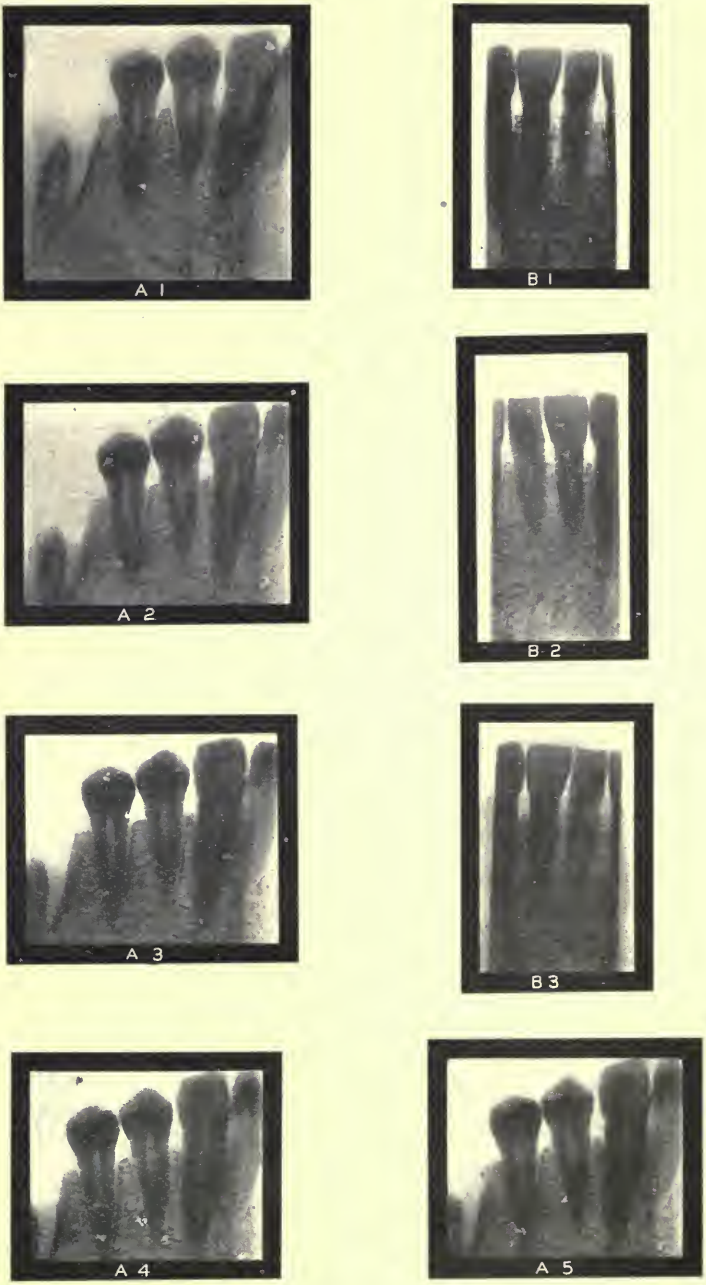

Fig. 13a.

Fig. 13b.

tains any quantity of pus the area is generally particularly dark. This is caused by the fact that pus has been found to be fluorescent under the influence of the X-ray." The writer will not enter into the question whether pus is fluorescent; he believes that the light area appears due to the resorption of X-rays in accordance with the density of pus, when pus is at some distance to the film.

The result of his research is that pus showed a higher co-efficient in absorption than water in the examination with the soft ray (W-5), while in the case of the hard ray (W-9) it shows a similar co-efficient to water, Fig. 12a, shows water, b pus, both radiographed by W-5, while in c and d by W-9 was used. In the case of empyema of the antrum of highmore it is observed that one which has pus presents a darker area than the normal antrum, but in regard to the fluorescence we could not notice any noticeable appearance.

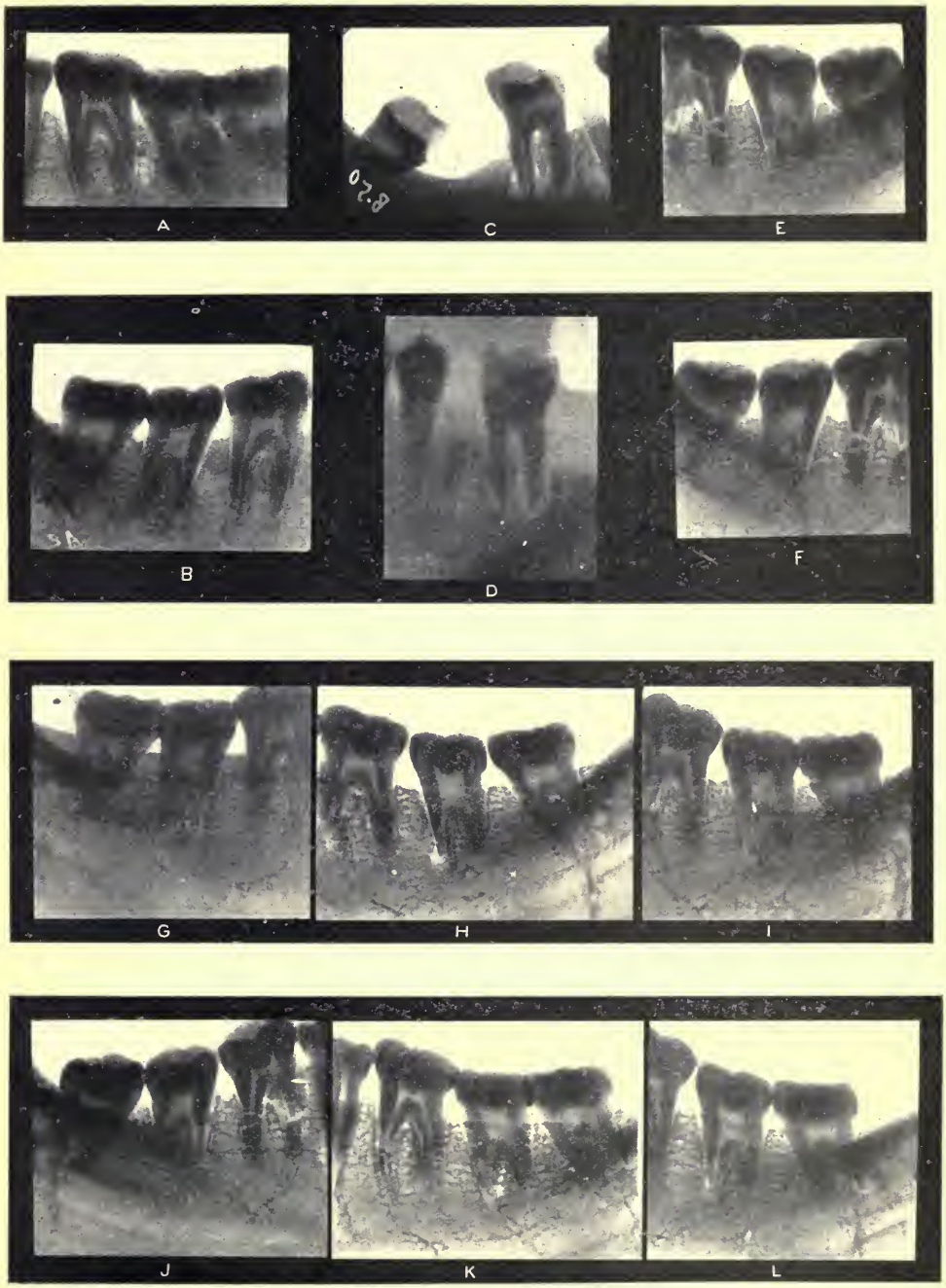

Fig. 14.

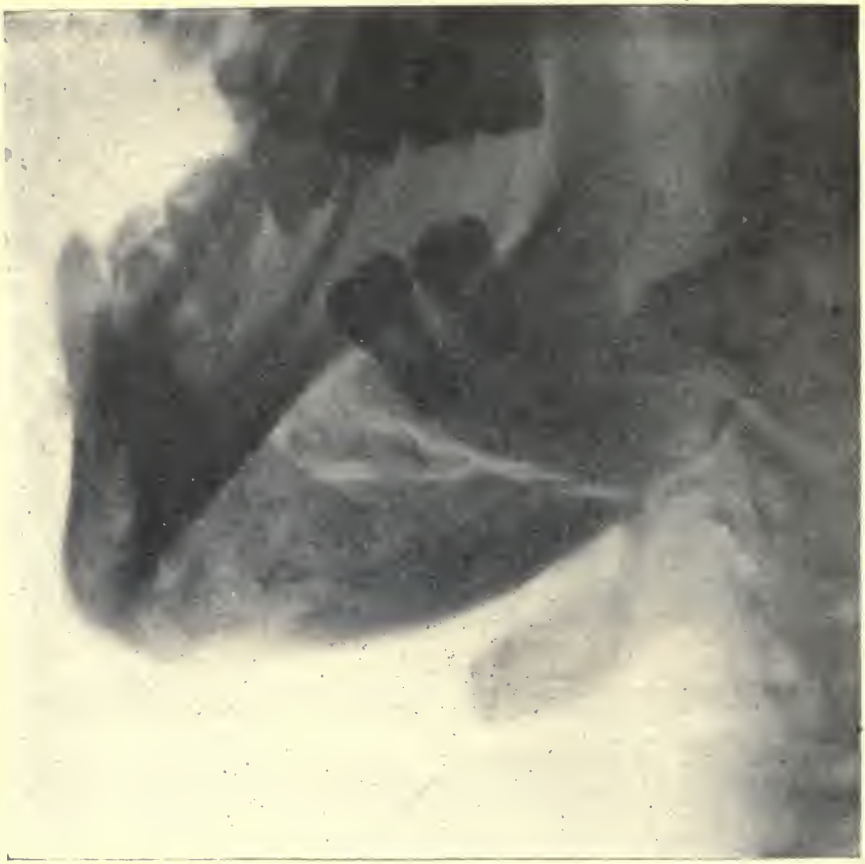

Fig. 15.

As far as the writer's experience goes, it is impossible to differentiate in radiographs the appearances of abscess, granuloma, and radicular cyst. Though the appearance of these diseases is quite typical and evident enough to read readily, it does not depend on the difference in the contents, but rather the different appearance of the margin, due to the destruction and regeneration of bone surrounding the diseased part. The writer has endeavored to confirm this opinion by carrying out several experiments.

Author's Experiments.

When the writer inserted tissues of the diseases in question into defects in the bone, and examined the differences which would follow by this process, he did not see any noteworthy differences between the above mentioned three diseases. The clinical fact gained by this ex-

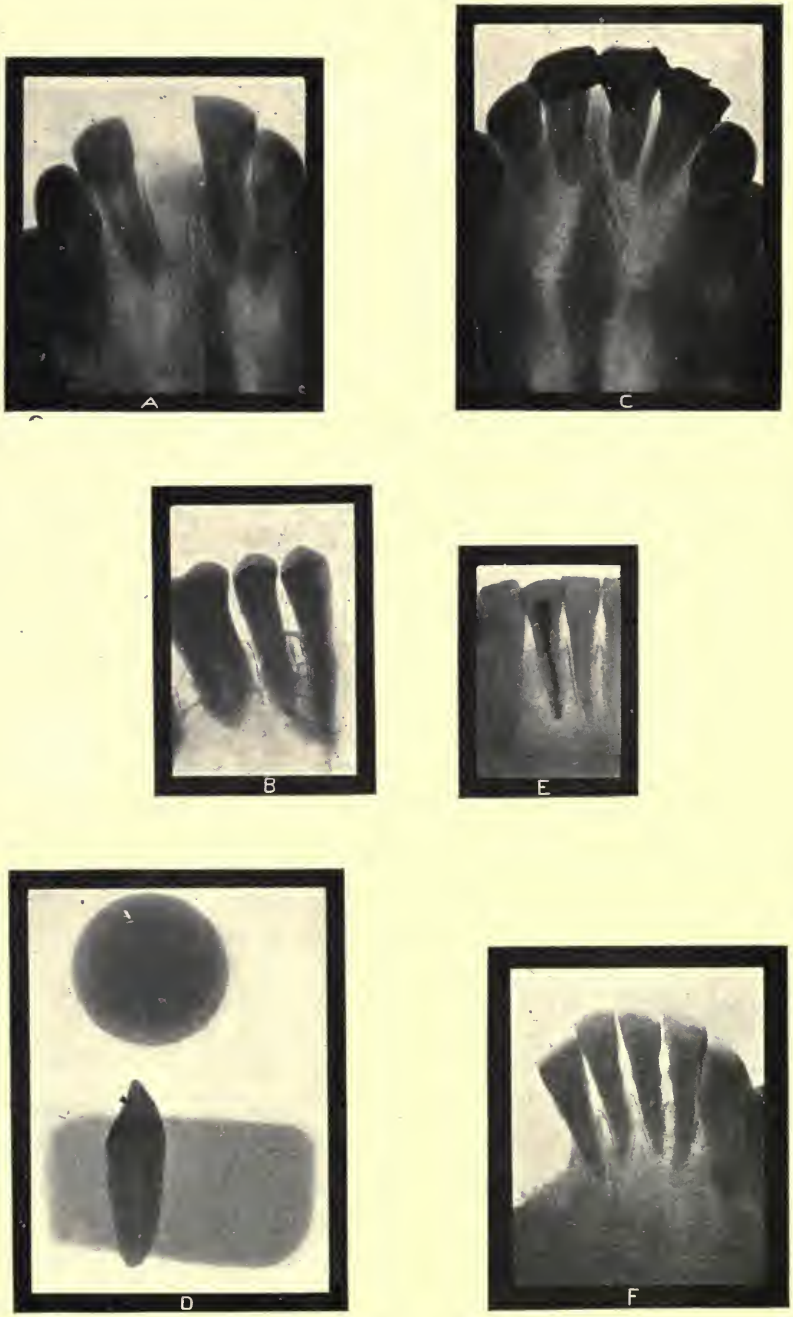

Fig. 16.

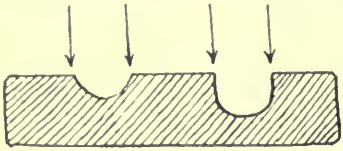

Diagram E.

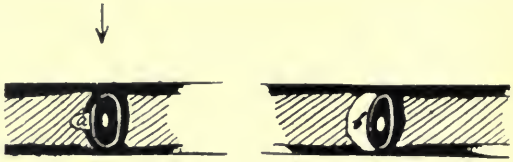

Diagram F.

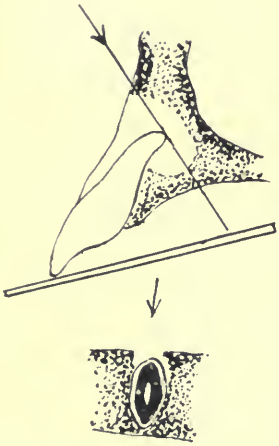

Diagram G.

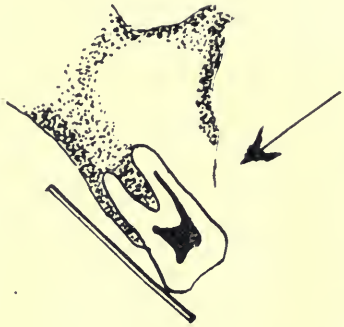

Diagram H.

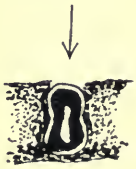

Diagram I.

Diagram J.

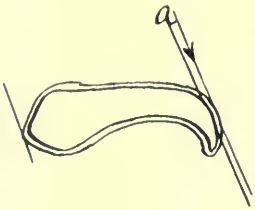

Diagram K.

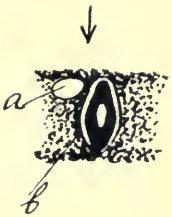

Diagram L.

periment was only that the inserted tissues present some slight darkness in comparison to the utterly hollow bone.

Now the writer wishes to report the relation between the radiographic appearance and the substantial change of the disease as the result of his own research, as follows:

1. There is a stratum of a compact bone which is exceedingly dense, at the part between the superficial surface of the mandible and the teeth. This stratum is extremely difficult to diagnose, unless a diminution or disappearance of calcium salt takes place· (See Fig. 13A, a, b). Consequently though there may be a serious disease in the bone marrow, we cannot diagnose it at all. (On Fig 6, a, shows the normal appearance, b does not prove any change though the molar region and spongy bone is got rid of.)

2. The gradation of the light area is always due to the depth of the pathological change of the hard tissue or the depth looked on from the direction of the ray. Though the gradation is sometimes influenced by a bone tissue in the direction of ray, it is exceptional. (In its case, it is not related to disease of the bone marrow.)

3. The sharpness at the margin shows disease which is deep in the direction of ray (an examination on this problem is shown in Fig. 2g, which will be compared to Diagram E).

4. According to the appearance in Fig 2h, the disease is seen to be localized, but it is quite serious contrary to the appearance. Unless it is like g (Fig. 2), it will not be seen as such, as shown in Fig. 13 and in Diagram G. As seen in Diagrams F and G, a defect like "a" will not be recognized at all, as it is obstructed by the hard tissue at both sides. It must be radiated as in "b" at least.

5. In the hard tissues, some changes are not shown in radiographs.

Abscess which occurs in the alveolar process, in line with a tooth in the maxilla does not show even if it has once pointed. (See Fig. 13A, and the Diagrams H and I.) With regard to the abscess in the mandible, only that which has pointed may be read. But a simple defect on the buccal side if attached to the tooth is not to be seen (Fig. 14).

The tubular defect (fistula almost perpendicular to the direction of rays does not appear in most cases (Figs. 13 and 14 show the defect is not to be seen).

A fistula is formed along the buccal root chiefly, and consequently the fistula is quite difficult to diagnose by means of radiographs. That we cannot diagnose such a case as a defect which occurs on the lingual or palatal side is not remarkable as the tooth and the defective region lie in the same direction of ray (Fig. 14).

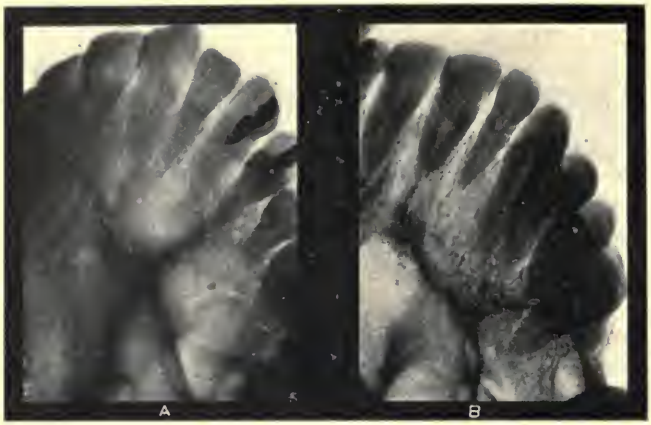

Fig. 17.

6. Among the fractures of the teeth and maxilla, the fissure is almost impossible to be shown in a radiograph (Fig. 13a). Only in the case of fracture, where the opening is remarkable, are we able to demonstrate with a radiograph (Fig. 15), yet in 14e, f, g, h, i, j, k, l, this serious fracture is not demonstrated.

7. There appears a light line in the region of the pericementum. This light line appears more vivid, by the existence of neighboring hard tissues, with the exception of the neighboring thick bone tissues, in which case it will not appear at all. The phenomenon where we see a broad line instead of a narrow line is due to the disappearance of calcium salt of the surrounding hard tissues (Fig. 16 shows absorption of surrounding tissues after the replantation of the teeth). From this appearance, we should diagnose a pathological change.

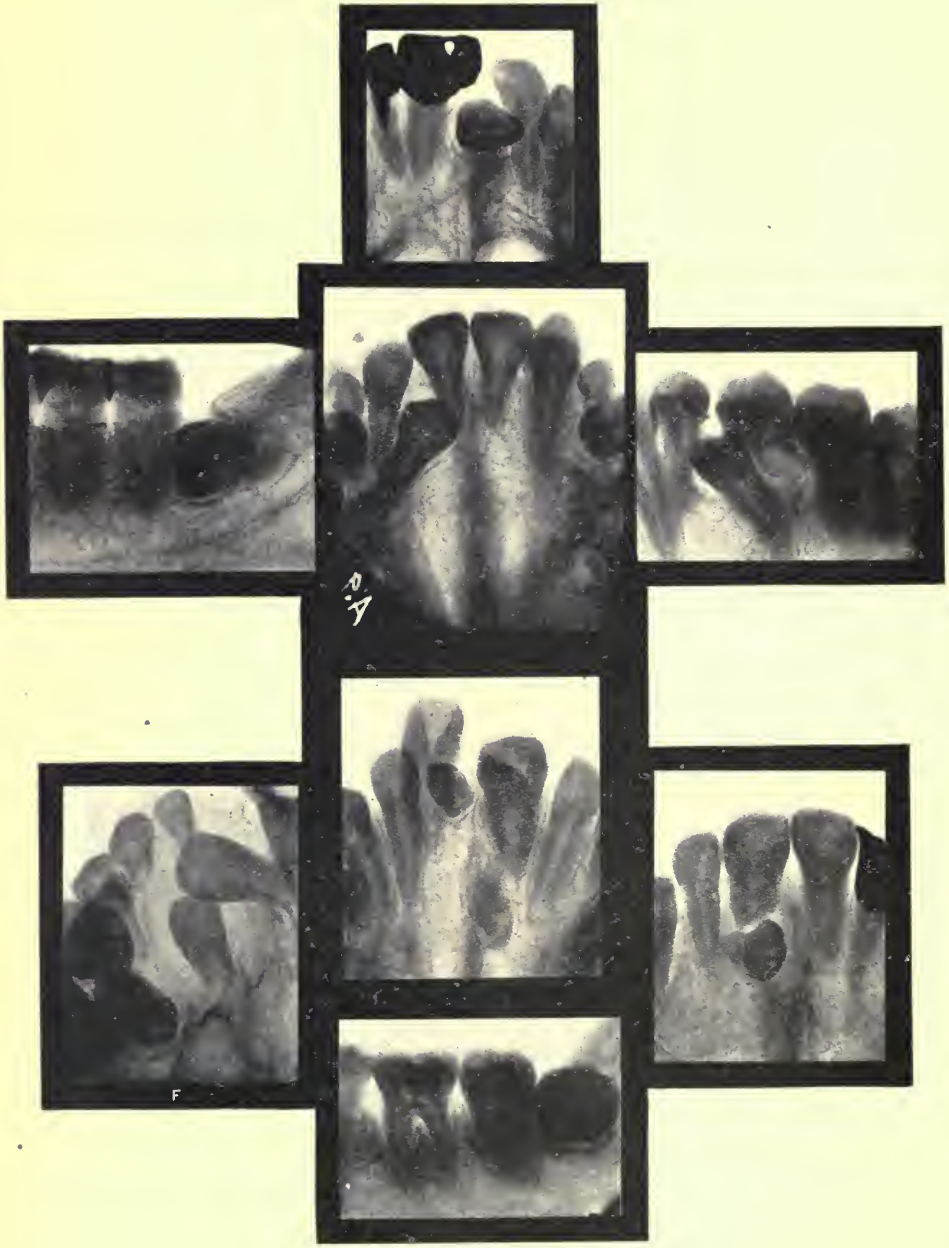

Fig. 18.

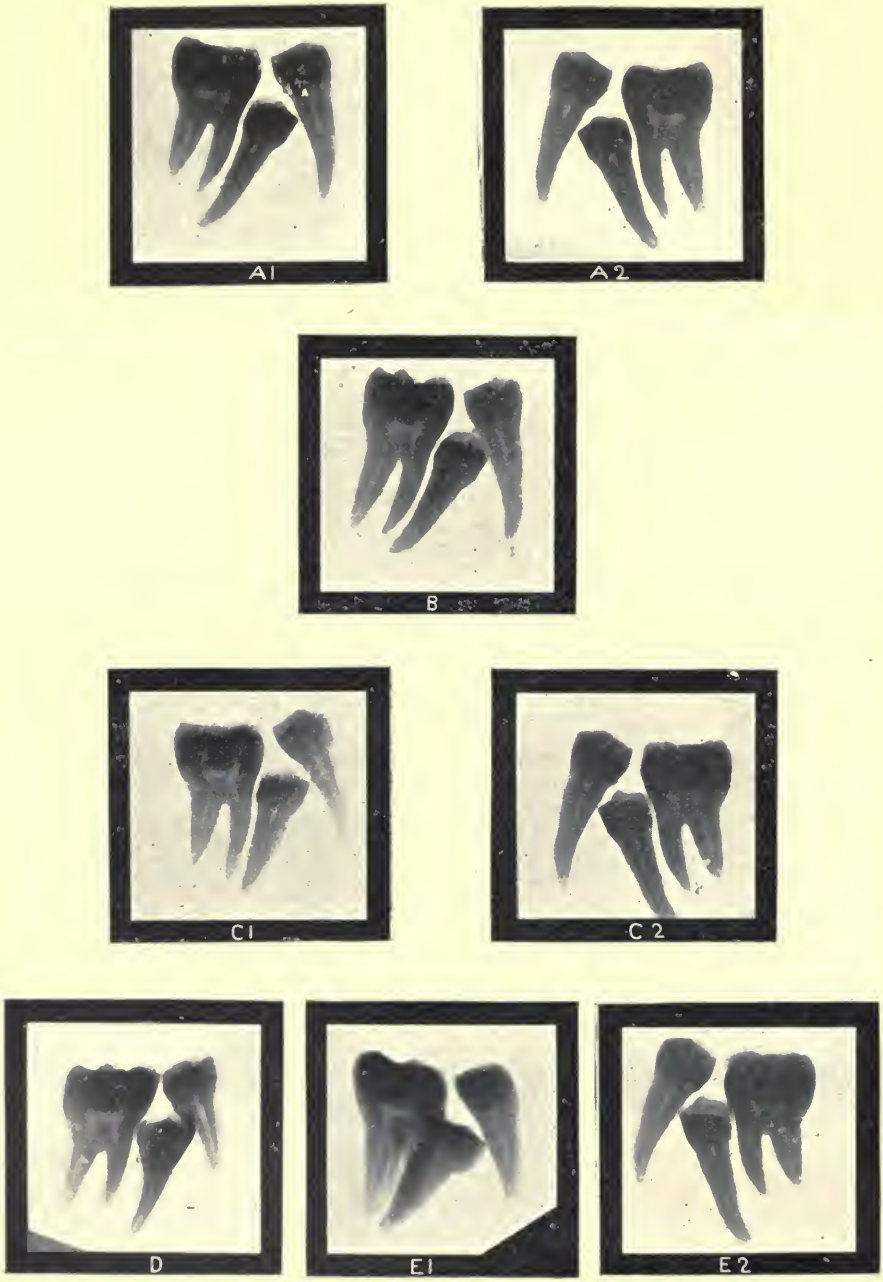

Fig. 19.

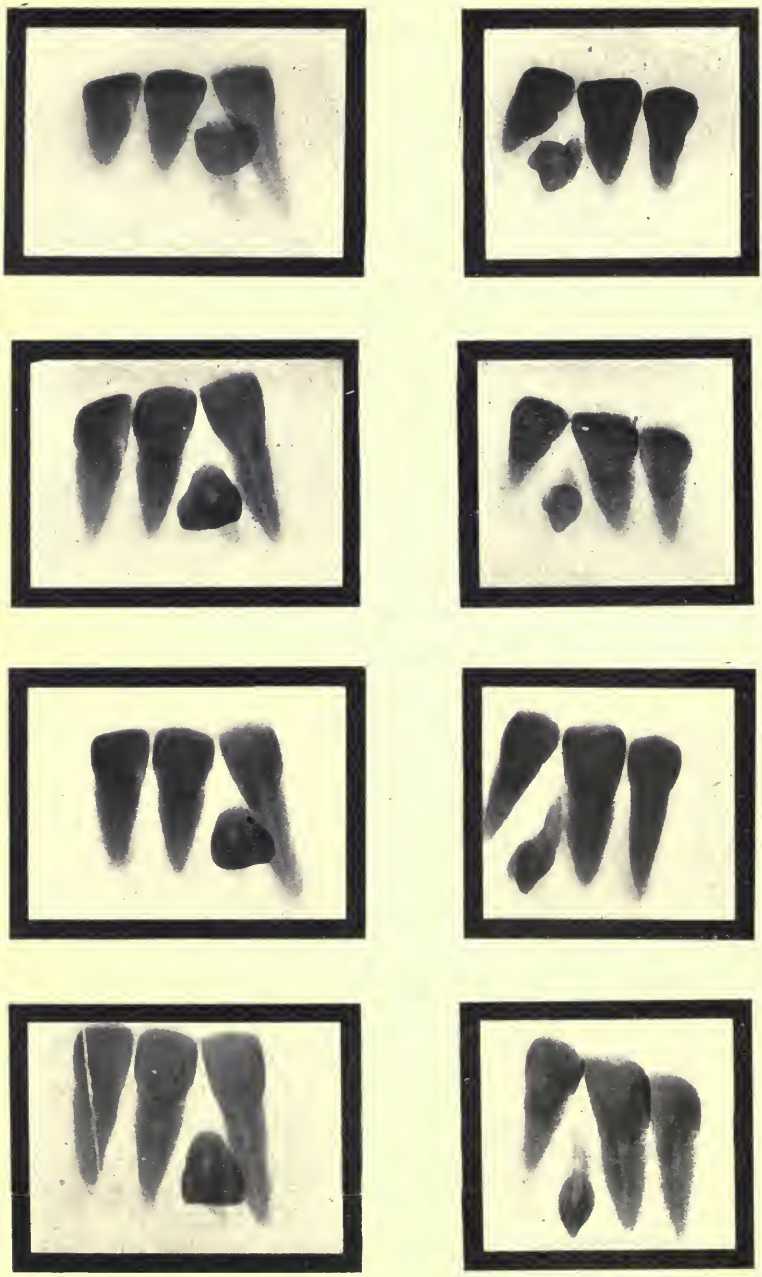

Fig. 20.

Fig. 21a.

The broad light line which appears in a radiograph shows the fact that the root is opposed to the free passage of the rays (Figs. 16f, 3e and Diagram J). The broad light line which appears vividly near the root shows that the root is curved (Fig. 17c). Where the light line surrounding the root is broad at one side and obscure at the other side it shows the fact that the root is opposed to the ray (Diagram K); the direction of rays is shown by the arrow.

8. When the two teeth are in the same direction, and one tooth is seen surrounded with a transparent line and the other presents such an appearance as when absorption has taken place (Fig. 18), we have the phenomenon ordinarily observed in the case of impacted teeth. The double radiograph should be made, when an accurate diagnosis is necessary (Fig. 18d).

9. In impacted teeth, the light line is always broad and distinct. When the margin is light uniformly or the light line is too broad, we should diagnose it as a radicular cyst (Figs. 18f and 13B).

10. Instead of the fact that the diseased part lies surrounding the root, the light area is also observed together in the pericementum mem-

Fig. 21b.

brane (Fig. 14, and Diagram L; in the diagram the dark line of the b region appears together with the diseased part a); this proves that the tooth and the diseased part have no relation. See Fig. 16a, c, e, f, with regard to the pericemental membrane. A shows the socket of a lost tooth, c, the absorption in the surrounding part a month after the transplantation at place of the lost tooth.

11. The diagnosis between such diseases as cyst, granuloma, and abscess, and the appearance according to the condition of bone has been stated so far, and it is diagnosed satisfactorily when we are quite familiar with the appearance of the normal tissues, and make radiographs by the method required by the situation. But the diagnosis will be difficult when a deformity of bone is present and it is radiographed by a special direction of rays. Differentiation is made by the appearance of a dark line surrounding the light line, or sometimes by the conditions of the light line corresponding to the pericemental membrane of the tooth which is submitted to diagnosis. In that case no dark line appears in the surrounding part of the diseased part and the light line corresponding to the pericemental membrane is not evident (Compare Fig. 17d, to a, b, c, e).

It will be easy to discern the difference between that, the formation

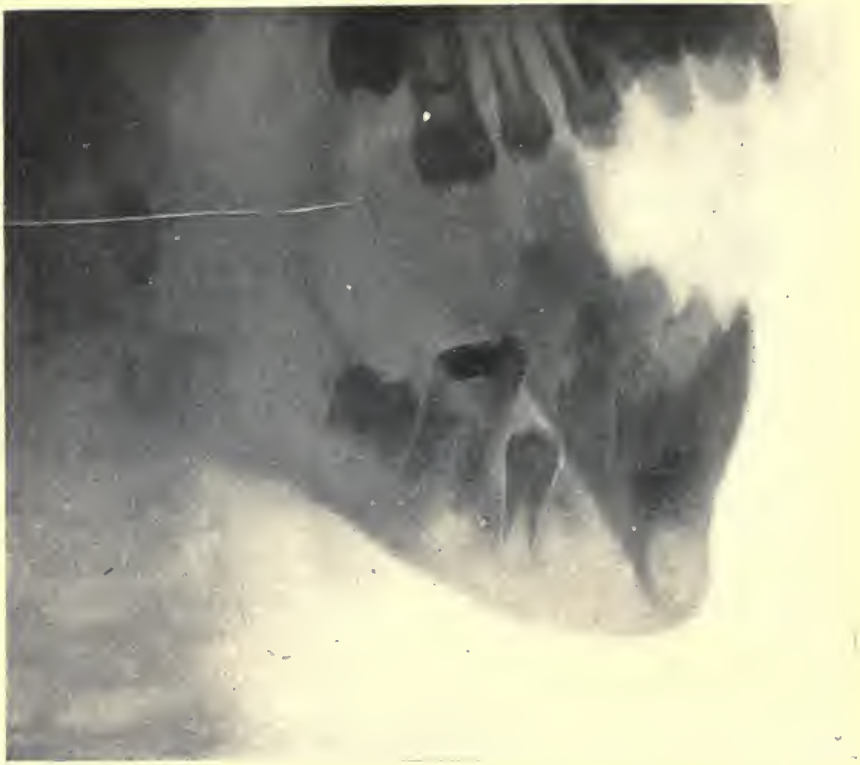

Fig. 22.

of which is not yet completed and a pathological change in the pericemental membrane. When the root is in the course of formation, the *foramen apicale* is peculiarly wide and there will be seen a stratum of slightly dark color surrounding the light line (Fig. 22). When suppuration present, the dark stratum will disappear.

In the course of several observations on the margins of diseased parts, the writer had a special interest in the research related to Fig. 16d. The fact that a very light dark line appears in a very chronic diseased part is explained in the same way.

12. Whether the root of the upper molar penetrates the *antrum maxillæ* is solved by means of the light line in question; as has been already stated, the light line becomes more vivid in accordance with the surrounding existence of the hard bone, so that the line will not be presented if the apex penetrates the antrum (Fig. 16b). Accordingly it is impossible

to diagnose when suppuration takes place in this region. The root which is surrounded by bone tissue shows a light line at the circumference of the root within the area of *antrum maxillæ* (Fig. 17b and c).

13. In the examination of the root canal in which a metallic foreign body is suspected after the filling, the tube will be used in a soft state and we should prolong the time of exposure (Fig. 9a). By this process, fillings with a material which has a high co-efficiency in absorption, such as gutta percha, paraffin containing bismuth, will be diagnosed satisfactorily.

The writer has endeavored to describe all the possibilities of radiography, but it must be admitted there are some cases where we are utterly at a loss to show pathological changes though they are within the influence of radiology. Besides there are some cases which seem apparently localized but are exceedingly serious in reality. The writer has observed too frequently that we are led to some remarkable mistakes in the examination of dead bodies. For instance, in Fig. 2f, we could not observe any disease, but when it was dissected, a cyst at the root the size of a thumb was found. A, b, c, d, and e, f, g, h, i, j, k, l in Fig. 14 are radiographs of the same subject taken from different directions. In the one we see a remarkably distinct change, and in another we do not, or in one a localized change is seen, and in another a broader one appears vividly.

By repeating the observations in this way, we come to the conclusion that it is very dangerous to rely upon only a single radiograph. The writer claims it is necessary for most examinations to make the double radiograph. Though stereoscopic radiography is valuable in the diagnosis of diseases, it is not to be hoped that it will be generally employed. In order to make the difference between the simple radiograph or the stereoscopic radiograph, and the radiograph made twice, which is recommended by the writer, he wishes to call the latter "double radiography."

The advantage of double radiography lies in the avoidance of mistakes in diagnosis; and secondly it is advantageous to ascertain the position and shape of an impacted tooth. In regard to the position of the impacted tooth, we may determine certain factors. The writer has confirmed further the advantages of the double radiograph by making several radiographs taken from various directions (See Figs. 19 and 20).

In order to compare the radiograph to that of the normal tissues, as stated already, first the writer radiographs in a normal way. Next, the position of the film is the same as in the first case, but the tube is moved about 10 cm. in the plane perpendicular to the axis of the tooth, and the direction of rays is on the central part of the object.

The diagnosis differs according to the case; the greater the change of the appearance is, the deeper to the bucco-lingual sides and the more distant to the film it lies. Even in this examination, there may be some cases that are beyond the possibility of diagnosis.

Conclusion.

In the radiographic diagnosis, determine a certain condition (1) and make radiograph presenting the appearance of the normal tissues, and bear in mind this appearance as the normal appearance. (2) Every radiograph taken of any suspected condition should be compared to the normal. We should take extra precaution in all cases where mistakes are probable. All change which appears in the radiograph is caused by the diminution, or the increase of calcium salt; so that it is quite impossible to ascertain whether the contents are pus, granulomatous tissue or serum

We should remember that even if serious diseases are not observed in the radiographs in some cases, it depends upon the dimension and position of the change. Furthermore, besides this exceptional circumstance, we still have some cases that cannot be diagnosed. We will make some dreadful mistakes if we are to diagnose only by a radiograph taken from one direction. For these reasons, the writer believes the correct diagnosis needs the double radiographs.

Literature.

Indication of Dental Radiography, E. J. Eisen, D.D.S., and Paul Eisen, M.D., The *Dental Cosmos,* August, 1913.

Note on Dental Radiography, J. J. Moffitt, D.D.S., The *Dental Cosmos,* September, 1913.

Measurement of the Amount of X-Ray Employed in Marking Dental Radiographs.—Pathological Change in the Jaws Resulting Incidentally in Impacted Teeth and Other Disturbances, M. H. Cryer, M.D., D.D.S., The *Dental Cosmos,* March, 1914.

Dental Siagraphy, Herbert McIntosh, A.M., M.D., The *Dental Cosmos,* April, 1910.

Ban und Topographie des Alveolorfortsatzes in Iberkiefer, Dr. Rudolf Loes, *Vierteljahrscrift für Zahnheilkunde,* July, 1909.

Use and Advantages of the X-Ray as an Aid to Dental Diagnosis Including the Differentiation of the Radiographic Appearance of Normal and Abnormal Tissues, Howard R. Raper, D.D.S., The *Dental Cosmos,* June, 1915.

Die Untersuchungen der Zähne u. Kiefer Hauptmeyer u. Albers-Schönberg. Albers-Schönberg, *Die Röntgentechnik,* 1913.

Uber die Rentgenphotographie in der Zahnheilkunde, Dr. Port u. Peckert, *Deutsche Zahnheilkund in Vorträgen,* 1909.

Elektricitat u. ihre Verwendung in der Zahnheilkunde, Dr. R. Dorn.

Rentgenphotographie in der Zahnheilkunde, Prof. Dr. W. Dieck, Verhandlungen des V. Internationalen Zahnarztl, *Kongreses Bandt.,* 1909.

Archiv u. Atlas der Normalen u. Pathologischen Anatomie in Typischen Rotengenbildern, Prof. Dr. W. Dieck.

Dental Electro Therapeuticus, 1914, F. Sturridge, D.D.S.

Dental Radiography, 1913, F. L. R. Satterlee, D.D.S.

Elementary and Dental Radiography, 1913, H. R. Raper, D.D.S.

Papers Presented in Section III.

Chemistry and Metallurgy

Some Refractories Used in Dentistry.

By Guy Stillman Millberry, D.D.S., San Francisco, Cal.

Dentists frequently have occasion to use refractory materials; indeed, they are using refractories of some sort in everyday practice, but have probably never considered them as such.

A refractory substance is one which is capable of withstanding high temperatures, without marked changes in form or composition. The value of refractories, in the industrial world, is in direct proportion to this, the predominating property.

All our silicate cements possess some of the properties of refractories, as do the porcelains, asbestos, slate, investment compounds, furnace linings, and many other substances which are a part of the equipment or supplies in a dental office.

Let us look into the origin of some of the more common refractories, then classify them and determine their value in dentistry.

Geologically speaking, rock includes all beds of sand, gravel, clay and volcanic ash, as well as granite, sandstone, and limestone. Rocks are classified according to their genesis, as:

1. Igneous rocks, which have solidified from molten material.
2. Sedimentary or stratified rocks, which are laid down chiefly under water by means of mechanical, chemical or organic agents.
3. Metamorphic rocks, those formed by subsequent alteration by wind or weather.

Most rocks consist of one or more minerals. Granite, for instance, though seemingly simple in substance, is a compound rock, while quartz and some of the calcium rocks are composed of but one substance. I will ask your indulgence for a moment while we consider these three classes somewhat in detail, because the refractories which we use originate from variable sources.

Igneous Rocks.

Igneous rocks have been formed by the consolidation of molten material, usually forced upward from the depths of the earth. If it reaches the surface it is known as volcanic rock, and if not, as plutonic rock. Chemical analyses from all parts of the world show that

the constituents are chiefly oxides of silicon, aluminum, iron, magnesium, calcium, sodium and potassium. When the oxide of silicon predominates they are acid in reaction, and when low in this oxide they are basic; in fact, silicates which constitute the largest part of the earth's crust are spoken of as salts of silicic acid.

The glassy rocks (and by glass is meant that group which solidify without crystallization, as obsidian), are of igneous origin, as are some minerals. They are usually massive and appear homogenous without evidence of stratification, foliation, or banding structures which are common to other forms of rock. Pumice, though metamorphic in appearance, is a glassy rock, its vesicularity being due to the rapid escape of water at high temperatures. Fossils are never found in true igneous rocks.

Sedimentary Rocks.

Sedimentary rocks are of secondary origin, laid down as sediments on land or under water. They are derived from physical disintegration or chemical decomposition of pre-existing minerals, plants or animals, commonly known as weathering. When moved from their original source by water they are classed as aqueous sediments, such as shales and sandstones; if by wind, as æolian sediments as sand dunes, and if by glaciers as glacial sediments. They include all substances from silt to boulders, but the finer, more homogenous kinds are generally spoken of in these terms.

This sedimentary material is frequently bound together by the deposition of mineral matter, such as cuprous carbonate, and ferrous oxide, etc., which is held in solution by percolating waters, and it may be converted into solid rock by great pressure. Such rock is usually simple in composition, stable in character and may vary in thickness from a fraction of an inch to hundreds of feet.

Metamorphic Rocks.

Metamorphic rocks are deformations of pre-existing types, classed as mechanical when due to movements of the earth, or by wind, and chemical when altered by liquids, gases or heat.

Asbestos.

Let us now consider some of these substances in detail. Asbestos is probably more commonly used than any of the others in laboratory practice. It is a mineral consisting of metasilicates of calcium and magnesium, with the latter sometimes replaced by iron, known as actinolite and a hydrous magnesium silicate known as serpentine, of which the chrysotile variety is the chief source of asbestos. This latter form is usually found in veins in massive serpentine. It may be of igneous or metamorphic origin, usually the latter, as an alteration product of magnesium silicate.

Due to its fibrous flexible structure it may be woven into a cloth valuable for fire-proofing and insulating.

The decomposition of asbestos materials by acids varies, depending on the character of material and constituents, such as binders, etc. Pure asbestos as such is insoluble in acids, but when organic substances or inorganic compounds soluble in acids are used as binders, decomposition naturally follows.

I need not mention in detail the many uses of asbestos in fibrous or powdered form, but you are not familiar with a prepared product, marketed under various names as transite and asbestos lumber. It is a composition of asbestos and Portland cement formed under hydraulic pressure into slabs of varying dimensions, as: 42 x 48 inches and 36 x 96 inches, with a thickness ranging from one-eighth inch to one inch. It is a very suitable material for laboratory bench tops where acids are not used, and especially to protect walls or woodwork from blast lamps and blow-pipe flames. The thicker slabs will withstand a reasonably heavy swaging force. Keasby Mattison Company and H. W. Johns Manville Company are manufacturers of this product.

Talc Soapstone.

Talc, and soapstone, which is an impure form of talc, are very similar to asbestos chemically, the exception being that they possess more silicon and less water. In consequence of this they are somewhat different in physical appearance. Being more homogenous in appearance, somewhat amorphous in character, they are well suited for laboratory sinks where acids are being constantly used, and may be used for switchboards or as an insulating material. Durability, insolubility and good heat resisting qualities are characteristic properties of talc and soapstone.

Mica.

Mica is a very complex substance, an orthosilicate of aluminum with one or more of the following elements combined with it, viz., potassium, lithium, magnesia or iron. It is very elastic and a non-conductor of heat and electricity, found usually in dikes. The darker colored micas containing the latter two elements are most infusible but more soluble in sulphuric acid. They possess a perfect basal cleavage, allowing them to be split into thin, tough, flexible plates, and as such are used in stove doors. Mica has been used as a door for electric furnaces, but at the temperatures necessary to fuse porcelain it frequently flakes off, falling into the furnace, and if the resistance wires happen to be exposed it may combine with them, thus aiding in their crystallization. Phlogopite or amber mica, a ferro magnesian variety, is used very extensively in

commutators. It is a most satisfactory insulator and possesses about the same hardness as copper.

Corundum. Corundum—aluminum oxide, a hard crystalline mass—is occasionally found in grains or shapeless masses. It is next to diamond in hardness, and, therefore, has been used extensively as a polishing grit or for grinding purposes. Magnetite corundum is known as emery.

Prior to the discovery of carborundum, which is a manufactured product, corundum was extensively used as various shaped polishing stones. Being non-cohesive, shellac was used as a binder. The heat generated by friction, unless water was used, reduced the stone to a plastic mass, which rendered it useless. Occasionally dentists make use of nitric acid to cleanse grinding and polishing stones of the accumulated débris and metal, and even though corundum is not soluble in acids, the binder is, and the procedure in so far as corundum points are concerned is a failure.

Slate. Slate is a metamorphic equivalent of muds and shales, but is not formed by sedimentation, as the latter are. It may be derived from aqueous sediment or from igneous origin, the latter form being exceptional. It represents the finest particles of mineral matter and its use and durability depends upon the texture and mineralogic constituents. The change is produced by dehydration and crystallization, though the mineral grains are too small to be seen by the naked eye.

Clay slates are formed by a uniform and gradual pressure upon mud beds, during which time the material is cemented together by carbonates of lime or magnesium, kaolin, or combinations of iron. Mica slates are formed by a metamorphic process in which the kaolin and feldspar have passed into mica, forming a crystalline fabric enclosing sedimentary particles. Nearly all slates originate in marine deposits of clay and sand.

The color ranges from black, attributed to carbonaceous matter, as marine organisms on the sea floor, through gray, green, red and purples. The corrugation is attributed to radiation of heat of earth and subsequent contraction. The constituent elements include many of the alkalies as well as the alkaline earth group, aluminum and iron with some carbon and phosphorus.

Slate is, of all refractories, the most suitable for bench tops, and it seems strange that manufacturers have not made use of it as such. From 20 per cent. to 40 per cent. of the quarried product is available for mill stock, which includes all smooth forms for building purposes. Its value as a bench top is based upon the properties of insolubility and im-

permeability, especially with regard to acids, its high heat resisting qualities, smoothness, durability, and non-liability to fracture under ordinary swaging force.

Clays. Clay products are probably more commonly used and the clay industry more widely distributed than any other single mineral in the world. Every State and Territory in the United States, except Alaska and Hawaii, produce burned clay products. In most of the clay working industries, especially the low grade products, as brick, tile and pottery, the manufacturer is the miner as well, but with the high-grade clay products this is not so. The chief properties of clay are: high shrinkage, variable plasticity, tensile strength, hardness, non-absorption, and color. Clays are metamorphic rocks; that is, they are all derived from some other rocks, be it feldspar or limestone. They are classed as: (1) residual, where the weathering out of some substances leaves a clay bank as a residue, or (2) transported where they are carried by water and deposited in banks.

Clay was probably primarily used for pottery, water carrying vessels and cooking utensils. Mention is made in an English record in 1744 of an application for a patent for making porcelain from a clay produced by the Cherokee nation of America. This incident does not, however, represent the earliest records of the clay industry, for besides the ruins on the Mediterranean the Incas and Aztecs give evidence of having used clay. Prehistoric workings in the Appalachian Mountains present traces of crude implements in some of the dikes, and even though these dikes contained feldspar, mica and garnet, it is plausible to believe that the search was for kaolin.

Kaolin. The clay we are interested in is the one chiefly used in porcelain, viz., kaolin with a formula of Al_2O_3 2 SiO_2 2 H_2O, and the substance from which it is derived, feldspar. Kaolinization is a process of decomposition and recombination in which potassium feldspar is converted into kaolin by a loss of K_2O with some SiO_2, and an absorption of H_2O. In the beds the strata are seldom uniform, as the kaolin seems to filter down until it settles in a bed of approximately 98 per cent. kaolin, on quartz. The alteration process is simply one of weathering, and the more plastic material is nearer the surface.

As previously stated, the silicates constitute the largest part of the earth's crust, and of this kaolinite, the hydrous aluminium silicate is the most common.

Reference is made by Felix Pascadis, M.D., Vice-President of the Chemical Society of Philadelphia, in an oration delivered in 1802, of

the "infinite service . . . the various kinds of clay . . . possess from common brick to elegant works of porcelain."

The value which kaolin possesses is its plasticity and infusibility. Due to its high refractory value, it retains its form even though the particles may be completely enveloped in fluid feldspar. It also has a remarkable resistance to the solvent action of fluid feldspar.

The change in form of these refractory materials, which we might consider as fusibility, is known as the deformation point. It is a pyrochemical process in which heat and time are factors. The same principle holds good in the fusion of porcelain. The deformation point is usually determined by seger cones, a clay product, graded to modify their form at indicated temperatures ranging from 1,150 degrees C to 1,850 degrees C at 20 degree intervals. Thermo-electric and optical pyrometers are unsatisfactory. Another method of testing is to obtain standard materials and make test mixtures. Kaolin is purified by a washing process in which sand wheels, mica troughs, screens, concentration tanks, filter presses and driers are used.

Feldspar. Feldspars all include potassium, sodium and calcium, besides aluminum in silicate formation. Due to alteration reactions by weathering and the presence of water carrying CO_2 the alkalies are converted into soluble carbonates and are leeched out; the resultant compound being kaolin. Calcium silicates are likely to resolve into calcite.

Feldspar in a porcelain mixture is the cementing mixture. When subjected to sufficient heat to merely soften it, it becomes a bond, but when fluid it acts as a solvent, producing a more homogenous mass. When feldspar is in excess it causes warpage. To avoid this, kaolin should constitute at least 50 per cent. of the mixture, a good formula being: feldspar 20, kaolin 50, and quartz 30, mixed with 50 grams of water. The fusing of porcelain is thus seen to be merely a physical process, though termed a pyrochemical one.

Quartz. Theoretically, this is known as a pure crystalline silica, but it is rarely found pure. The best quality is known as sugar quartz, and is usually found in the vicinity of feldspar and kaolin dikes. One of the distinguishing physical features between quartz and feldspar is that the former does not possess cleavage. It is highly resistant to chemical decomposition except in the instance of hydrofluoric acid, which readily attacks all silicates, and it is infusible before the blowpipe.

The so-called quartz glass possesses many properties which make it valuable to the dentist. When hot it can be plunged into cold water without danger of cracking. It is, therefore, suitable as an annealing

tray for gold, being superior to any of the forms of clay which in the course of time become roughened on the surface and partially decomposed.

In the form of tubes it may be wound with Nichrome wire for electric furnaces having a low temperature, though Nichrome nor any of the other resistant wires of the nickel chromium iron group have proven satisfactory in temperatures necessary for the fusion of porcelain. It could, however, be used satisfactorily for heating purposes, such as drying-out investments, etc., thus avoiding the use of the open flame.

Magnesite. Magnesite or magnesium carbonate is a new type of refractory in so far as building construction is concerned. When calcined, pulverized and mixed with magnesium chloride, it makes a strong fireproof cement for partitions or floors. It is basic in character and, therefore, of value in treating basic ores in crucibles, but does not resist acids and is, therefore, unsuitable for general laboratory use.

In addition to these natural refractories, I wish to discuss two others, which, though native minerals or derived from them, are sufficiently modified by treatment to belong to manufactured products, and as such have been christened with trade names.

Alundum. Alundum, which is the mineral bauxite treated in an electric furnace until it gives practically pure fused alumina, is one of the best refractories for our use on the market to-day. It is crushed to grains of various sizes, then graded, refined and mixed with various binding materials.

When supplied in various shapes for various purposes, such as crucibles, filters, muffles, it is formed as desired and fired. The binding materials, unless they be of the nature of feldspar, are driven off by heat and a pure alumina remains. The melting point is 2,050 degrees C., or 300 degrees higher than platinum, and the latter substance can easily be fused in it. Its thermal conductivity is much higher than any of the other refractories, and consequently it is valuable as a lining for electric furnaces.

Aluminum oxidizes readily and does not give up its oxide freely. It therefore does not combine with platinum as does silicon or carbon, and there is less likelihood of crystallization of the latter metal. It is non-corrosive and has no chemical reaction, therefore is especially suitable for electric muffles.

Zirconia. Zirconia is another trade product. In 1878, M. H. Klaproth, a German mineralogist, discovered that sixty-eight per cent. of the mineral zircon differed from the other substances in the native compound, a silicate, and

on investigation it proved to be the oxide of an unknown element which was named zirconium. It occurs native in amorphous, crystalline and graphitic form, and is about as plentiful as carbon. It fuses at 2,350 degrees C. The natural oxide, eighty-four per cent. pure, is called zirconia. When refined it is obtained as a pure white substance, and the M. P. is raised to 3,000 degrees C. It was first used to replace calcium oxide of the Drummond calcium light and later by Von Welsbach as a skeleton for Welsbach lights, though thorium is now used in the latter instance.

Possessing a low thermal conductivity, it is not as serviceable for electric muffles as alundum. Mixed with magnesia, phosphoric acid, glycerine or starch as a binder, it can be molded into form, dried for several days, and fired at from 2,000 degrees C. to 2,300 degrees C. When thus treated, it is impervious to liquids, strong acids and alkali fusion mixtures, and will withstand sudden changes in temperature.

In presenting this brief paper on refractories, my thought has been to bring before you some information which may be useful in some of the occasional problems which we have to contend with in dental practice.

An Acidimetric Study of the Saliva and its Relation to Diet and Caries.

By John Albert Marshall.
From the Rudolph Spreckles Physiological Laboratory and from The Department of Dentistry of the University of California.

Among the numerous present-day investigators who are studying the saliva, there is one whose work has attained a prominent place in the minds of the profession at large: work which is important, not only from the dental standpoint, but from the bio-chemical standpoint as well. I refer to Pickerill's book, *"The Prevention of Dental Caries and Oral Sepsis."* He has given us some figures which seem to prove that by varying the stimulii applied to the salivary glands by means of foods or chemicals taken in the mouth, a saliva of different reaction may be obtained. It is this particular phase of the subject which I am presenting for your consideration.

Titration

For the sake of clearness, let us define for a moment a few of the chemical terms employed. By "titration" we mean the determination volumetrically or the determination by comparing volumes of the strength of solutions. For instance, if we wish to determine the acidity of vinegar, we may proceed volumentrically by adding a few drops of an indicator, as phenolphthalein, and adding an alkali, a sodium hydrate, of known strength until a permanent pink color results. By observing the amount of alkali added, and knowing the amount of acid in the tube, we obtain a direct comparison of the two solutions.

This reaction is similar, in a way, to the reaction which takes place when we titrate a sample of saliva. For this purpose we need normal or fractional solutions, indicators, and water, free from carbon dioxid.

Normal Solution.

A "normal solution" is one which contains its equivalent hydrogen gram molecular weight dissolved in one liter of pure water. If we wish to make up a normal solution of HCl, we consult our table of atomic weights and find that the atomic weight of hydrogen equals 1 and that of chlorin equals 35. Therefore, the molecular weight of HCl=36. Then for a normal solution of HCl every 1,000 cc. H_2O must contain 36 gram of HCl. For salivary work this is diluted 200 times, and we have a solution which contains 0.18 grams per 1,000 cc., or

.00018 grams per 1 cc. This solution is expressed by the symbol N/200.

An Indicator.

By an "indicator" we mean a substance which, by the addition of acid or alkali, always changes its physical state; as, for instance, its color. Litmus is an indicator; methyl orange, phenolphthalein, and para-nitro-phenol are others.

In the determination of the acidity or alkalinity of solutions, a certain criterion of neutrality has been established. This criterion is pure water, *free from carbon dioxide.* Certain substances also exhibit an amphoteric reaction. Amphoteric—from the Greek, meaning, "both of two," and such a reaction is one in which the fluid exhibits the power of neutralizing both acids and vases. Many of the body fluids show this phenomenon. Fresh milk is amphoteric; urine is often amphoteric to litmus; that is, it will show both an acid and an alkaline reaction to that indicator. Sutton (2) says, "Saliva which is generally neutral to litmus is always strongly alkaline to lacmoid or congo red, and acid to tumeric."

Pickerill's Method of Titration Criticised.

With these definitions clearly in mind, let us turn our attention to the method of titration used by Pickerill. The first thing that strikes us is that of his choice of indicators. He used methyl orange. Let me quote several authorities on the use of this indicator.

Sutton (2) tells us that "All titrations with methyl orange should be carried on at ordinary temperature. . . . . *if utmost accuracy is desired, the liquid titrated should not be too dilute.*"

Treadwell-Hall (3) says that "Methyl orange is suitable for the titration of strong acids as HCl, HNO_3, H_2SO_4, as well as H_3PO_4 and H_2SO_3. HCl and HNO_3 can be titrated with a sharper end point than is the case with H_2SO_4."

"The primary phosphates are neutral toward methyl orange, but the secondary and tertiary phosphates react alkaline toward it. With half normal solutions the end point is fairly sharp; with tenth normal it is less so. In the latter case, *an excess of 0.3 cc. of tenth normal alkali is necessary to change from red to yellow.* The error in analysis is greater in proportion to the amount of indicator employed, and also in proportion to the dilution of the solution."

Cohn (4) states: "It (methyl orange) is an excellent indicator, but it requires a practiced eye as well as considerable care. It possesses strong acid properties, therefore only strong acids can be titrated by means of it. Ammonium salts, sulphates, nitrates, chlorides seriously diminish the sensitiveness of this indicator; their absence should, therefore, be assured in order not to increase the liability of error which the

formation of these salts during titration induces. It is useless for lactic, citric, tartaric, succinic, butyric and acetic acids; in fact, almost all organic acids."

On page 188, second edition, Pickerill uses methyl orange for determining the reaction of lactic acid and saliva, one particular case in which methyl orange is useless.

Schimpf (5) says: "This indicator (methyl orange) *should not be employed when titrating with standard solutions which are weaker than decinormal* (N/10), nor should it be used in any hot solution, nor in excessive quantities. It is useless for most organic acids."

Kirke (6) says: "The alkaline index of Pickerill appears to be open to further probability of error by reason of the extreme difficulty of determining the end point of the reaction, owing to the unreliability of a weak solution of methyl orange as an indicator, which necessarily introduces the element of personal equation as a large factor of error in the observation."

There is no authority who advises the use of methyl orange in solutions weaker than N/10.

Applying our data which we have at hand to the alkalinity index. let us see what figures we obtain.

With N/10 solutions it is necessary to add an excess of 0.3 cc. alkali before we get the neutrality point. This means that 1.5 cc. N/50 H_2SO_4 is the experimental error.

Note next his alkalinity per cc. We find that this factor may be, for example, 1.05 or 2.55. Continuing we may then have an alkaline index of 1.73 or 4.21 for *normal resting saliva!* From these facts, the tables giving the alkaline indices are open to serious question.

Summarizing then, we note that Pickerill is fundamentally at fault in his choice of indicators, and that his experimental error of 1.5 cc. N/50 H_2SO_4 is too large to admit of the proof that even the alkaline index of normal resting saliva is 1.73. It has been shown that instead it may be as high as 4.21.

Influence of Diet Upon Saliva.

The influence of diet upon the saliva will next be considered. It was desired to determine whether a class of individuals, as a whole, subsisting for a definite period of time upon a certain regulation diet, evidenced any marked difference in the neutralizing power of the saliva from a like class of individuals subsisting upon a different diet.

The data presented were obtained from inmates of five different institutions, the groups being divided into the following general groups:

1.—Persons whose teeth presented neither decayed nor filled areas; these were classed as absolute immunity.

2.—Persons whose teeth presented no decayed areas, but who had fillings; these were classed as present immunity.

3.—Persons whose teeth were carious.

4.—Persons who had pyorrhea.

Each one of these four groups were sub-divided into those who took care of their teeth and those who did not.

The diets and the analyses of the different samples of saliva follow. The methods of taking samples and the methods of analysis have both been fully explained in two previous articles. (7) (8)

TABLE I.

Present Immunity, with care			Present Immunity, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
1	23.00	4.50	5	24.60	5.60
	25.50	4.30		24.70	7.20
	28.40	4.90		22.20	9.80
	16.02	5.86		19.30	14.40
	16.80	6.34			
	12.06	5.72	79	16.50	2.13
	13.70	5.42			
	20.20	6.42			
2	11.00	12.60			
	13.70	14.60			
	14.06	13.10			
	11.02	10.50			
	7.36	12.34			
	9.40	9.46			
	10.72	9.34			
	8.32	12.10			
	12.90	8.20			
3	17.70	4.50			
	19.50	5.60			
	17.50	5.40			
	12.50	5.00			
	9.94	4.82			
	8.94	5.02			
	9.20	5.30			
	18.10	3.40			
14	7.58	18.30			
67	13.70	4.97			
70	17.90	7.78			
	14.45	5.10			

Carious, with care			Carious, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
4	18.40	4.80			
	19.50	4.40			
	17.30	3.65			
	19.70	3.30			
	11.44	5.50			
	11.22	6.80	69	11.50	4.53
	13.00	5.58			
	20.80	3.23			
80	17.75	7.70			
81	28.80	5.82			
71	2.95	1.70			

Table 1 presents analyses of saliva from members of the faculty, office force and students. This table elucidates several points. We note first a wide range of variability of the so-called normal resting saliva, not only in different individuals, but in the same individual as well. Take, for example, patient 1. The variation in alkalinity is from 12 cc. N/200 HCl to 28 cc.N/200 HCl. The variation in acidity is from 4.30 to 6.42 cc. NaOH.

Patient 2 varies 7.36 cc. HCl to 14.06 cc. HCl
8.20 cc. NaOH to 14.60 cc. NaOH.

Patient 3 varies 8.94 cc. HCl to 19.50 cc. HCl
3.40 cc. NaOH to 5.60 cc. NaOH.

Compare next the oral conditions, those in which the teeth are immune from caries and those which are carious; we find that so far as the *normal resting saliva* is concerned, there is no relationship between these acidities and alkalinities and the condition of the oral cavity.

A third point which is brought out is the fact that the so-called acid mouth, or acid saliva, which has always been *associated with lack of care,* does not exist! This is rather contrary to what we have always been led to expect. But in nearly 200 cases, examined within the last two years from the chemical standpoint, there has never been a case where a *marked carious condition* has been associated with a saliva which was *notably acid.* These figures all show that the acidity of saliva, judging as such, or the alkalinity of saliva, judging as such, *is not related to dental caries,* or to immunity from dental caries! Note patient 4, table 1; the anaylses shows a relatively high alkalinity, but a low acidity. Why is not the acidity high? The patient has carious teeth.

TABLE II.

Present Immunity, with care			Present Immunity, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
11	10.70	5.80	8	10.30	9.26
	11.70	5.45		14.08	11.86
				14.20	4.50
65	10.60	9.86		22.22	7.60
103	7.80	7.53	64	11.40	8.67
			72	29.1	3.44
				22.50	6.28
				29.10	3.44
Carious, with care			**Carious, without care**		
16	14.60	8.30	6	16.60	7.10
	14.00	12.90		13.30	8.40
				11.00	7.50
71	2.95	1.70			
			9	4.70	9.70
102	15.70	7.40		3.30	12.00
104	17.30	17.40	10	9.80	29.30
				4.20	23.30
			15	13.38	3.12
				14.00	2.90
				16.50	2.20
			17	9.40	8.10
			18	2.80	22.10
				11.70	15.00
			20	4.70	13.20
				12.90	5.18
				19.20	7.20
				20.90	5.00
				16.60	5.43
			69	11.50	4.53
			76	18.50	7.00
			77	17.45	15.00

Turn to table 2; the same holds true as in table 1. There is no connection between the acidity of the saliva, when considered by itself, or the alkalinity of the saliva, when considered by itself, and dental caries, or immunity therefrom.

TABLE III.

Present Immunity, with care			Present Immunity, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
			32	8.96	7.20
70	17.90	7.78			
	14.45	5.10			
74	19.80	8.00			
75	26.60	4.30			
Carious, with care			Carious, without care		
21	15.36	2.74	22	8.15	6.20
			23	6.90	8.94
			26	12.52	3.16
Pyorrhea, with care			Pyorrhea, without care		
24	7.16	1.18	31	9.84	6.40
27	6.00	8.10			
Absolute Immunity, with care			Absolute Immunity, without care		
29	16.26	3.48	25	10.38	7.20
30	13.20	4.20	28	15.40	3.32

Table 3 shows the same relative variation in evidence, and we have also four cases of absolute immunity.

No. 29 is an American, 24 years old, who has never been in a dental office. He brushes his teeth night and morning.

No. 30 is a Mexican, 40 years old, who also has never been in a dental office, but he takes good care of his teeth just the same.

No. 28 is a negro who would not know what to do with a tooth brush if he owned one.

No. 25 is a Mexican. His mouth was filthy and his breath very offensive. He had a marked gingivitis; the saliva *was of a very ropy consistency, a condition considered predisposing to caries.*

DIET, JUNE 16, 1914.

INSTITUTION THREE.

Breakfast.	Dinner.	Supper.
Cooked cereal.	Stewed beef.	Macaroni.
Broad and butter.	Boiled potatoes.	Eggs.
Hash.	Boiled cabbage.	Fried potatoes.
Eggs.	Soup.	Broad and butter.
Milk.	Tea—coffee—milk.	Peaches.
Coffee.	Toast.	Tea—milk.
Fruit.	Syrup and Sugar.	Syrup and Sugar.
Syrup and Sugar.	Bread and butter.	

Meats vary—Pork and Mutton—Beef—Rice used.
Eggs and milk produced on place.

DIET LIST FOR ONE WEEK, JUNE 8, 1914.

INSTITUTION TWO.

MONDAY.

B. Mush—Cream of wheat.
D. Pork and beans.
S. Soup and biscuits.

TUESDAY.

Beefsteak and potatoes.
Stew and macaroni.
Beans and biscuits.

WEDNESDAY.

Mush—Rolled oats.
Hash (roast beef) and boiled cabbage.
Fruit (prunes, peaches or apple sauce).
Brown sugar, 3 tablespoonsful each ration.

THURSDAY.

Beefsteak and potatoes.
Lamb curry and rice.
Beans and rolls.

FRIDAY.

Mush—Cream of wheat.
Codfish.
Fruit (prunes, peaches or apple sauce).

SATURDAY.

Beefsteak and potatoes.
Stew and spaghetti.
Soup (vegetable) and rolls.

SUNDAY.

Mush—Oatmeal.
Roast beef—boiled potatoes.
Fruit cake.
Brown sugar, 3 tablespoonsful each ration.

Let us consider next the table d'hote provided by the State for these men. We note brown sugar twice a week, no white sugar, no eggs, no butter, but plenty of carbohydrate, one might say almost too much. *Ergo,* according to Pickerill, we ought to find a lower alkalinity than is reported in the above figures.

TABLE IV.

Present Immunity, with care			Present Immunity, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
36	21.64	4.41	43	15.14	4.80
40	9.90	8.00			
41	17.04	11.22			
Carious, with care			**Carious, without care**		
37	13.88	5.06	33	10.60	5.00
			34	10.60	3.80
			35	14.40	10.08
			38	12.60	3.42
			39	7.20	9.22
			42	12.30	9.90

In table 4 we have analyses from one of the insane institutions. Compare the diet with that of the preceding, and then compare the analyses. The difference in diet is at once apparent, but we find no corresponding difference in the salivary analyses.

TABLE V.

Present Immunity, with care			Present Immunity, without care		
Number of Patient	c.c.N/200HCl	c.c.N/200NaOH	Number of Patient	c.c.N/200HCl	c.c.N/200NaOH
55	9.04	4.02	46	13.38	5.10
			48	17.26	2.98
61	9.50	4.30	49	2.66	7.62
			50	7.14	7.52
			53	1.82	12.02
			54	12.52	5.80
			58	21.10	alkaline (trace)
			59	11.86	6.00
			51	11.32	5.54
Carious, with care			Carious, without care		
45	7.20	7.42	47	8.16	3.10
			52	16.32	1.00
60	12.40	4.60	56	16.64	2.64
			57	15.46	1.76
			62	7.90	12 70
			Pyorrhea, without care		
			62	7.90	12.70
			Absolute Immunity, without care		
			44	17.00	2.80

In table 5 is given a case of absolute immunity. The sample was quite thin and the secretion rather scanty. He was classed as a case of dementia praecox, and has been an inmate since 1884. In discussing the different forms of the disease with relation to the normal functioning of the organs, one of the medical officers of the institution stated that in certain cases all glandular action is modified and normal secretions are inhibited. Also, that indigestion and constipation prevail in many of these types. Dementia praecox and the paranoid cases seem to be exempt to a certain extent from these conditions. In katatonia drooling is constant, but this is attributed to the general systemic condition, in which the patient is usually indifferent to everything. There is also some loss of control, or co-ordination, and the patient does not swallow. The drooling is attributed more to this fact than to an abnormal salivary secretion. In fact, it is probable that the flow of saliva is lessened rather than increased, which is contrary to the usual belief among medical men in this field of work.

Referring again to table 5, there is a notation in regard to patient 58. This case, a Filipino, age 45, has been an inmate since 1901. Why the saliva from this person should react alkaline to phenolphthalein is at present under investigation.

DIET II.

Infirmary.	General Patients.	Attendants and pay patients.	Industrial Class.
Breakfast. Rolled oats. Milk. Bread and butter. Toast—coffee.	Breakfast. Rolled oats. Milk. Bread and butter. Rolls—coffee.	Breakfast. Rolled oats. Milk. Ham and eggs. Fried potatoes. Toast—coffee.	Breakfast. Rolled oats. Milk. Sirloin steak. Brown potatoes. Rolls—coffee.
Dinner. Vermicelli soup. Roast beef. Mashed potatoes. Creamed onions. Suet pudding. Bread and butter. Tea—milk.	Dinner. Vermicelli soup. Boiled pork. Steamed potatoes. Pink beans. Rice pudding. Bread.	Dinner. Cream of corn. Roast beef. Mashed potatoes. Creamed onions. Suet pudding. Fruit sauce. Tea—milk.	Dinner. Vermicelli soup. Roast beef. Mashed potatoes. Pink beans. Suet pudding. Tea—milk.
Supper. Vanilla custard. Bread and butter. Cake and fruit. Tea—milk.	Supper. Creamed farina. Fruit. Bread and butter. Tea—milk.	Supper. Cold meats. Potato salad. Cake and fruit. Tea—Coffee—milk.	Supper. Cold meats. Potato salad. Cake and fruit. Tea—milk.

JUNE 15th.

Infirmary.	General Patients.	Attendants and pay patients.	Industrial Class.
Breakfast. Cracked wheat. Milk. Bread and butter. Toast—coffee.	Breakfast. Cracked wheat. Milk. Bread and butter. Coffee.	Breakfast. Cracked wheat. Milk. Sirloin steak. Steamed potatoes. Toast—coffee.	Breakfast. Cracked wheat. Milk. Sirloin steak. Steamed potatoes. Rolls—coffee.
Dinner. Vegetable soup. Boiled beef. Mashed potatoes. Buttered beets. Tapioca pudding. Bread and butter. Tea—milk.	Dinner. Vegetable soup. Beef stew. Macaroni in cream. Cottage pudding. Bread.	Dinner. Vegetable soup. Beef potroast. Mashed potatoes. Buttered beets. Tapioca pudding. Tea—milk.	Dinner. Vegetable soup. Boiled beef. Steamed potatoes. Macaroni in cream. Tapioca pudding. Tea—milk.
Supper. Oyster stew. Bread and butter. Fruit. Tea—milk.	Supper. Boiled rice. Fruit. Bread and butter. Tea—milk.	Supper. Lamb curry. Boiled rice. Steamed potatoes. Fruit. Tea—Coffee—milk.	Supper. Lamb curry. Rice. Steamed potatoes. Fruit. Tea—milk.

Bread and butter with all meals.

Comparing as a whole the dietaries with the analyses, we fail to find any relation between the two, and we wonder if Pickerill is entirely correct in inferring that the diet is a leading factor in influencing salivary activity.

Another point which may be properly considered at this time is the condition of immunity from caries and its relation to the neutralizing power of the saliva.

Acidity plus alkalinity equals neutralizing power.

It has been shown previously by the writer (7) that when the salivary factor, which is the relationship between the activated and the normal resting saliva, is below 80 per cent., a condition of immunity may be expected; and when above 80 per cent., either incipient or rampant caries.

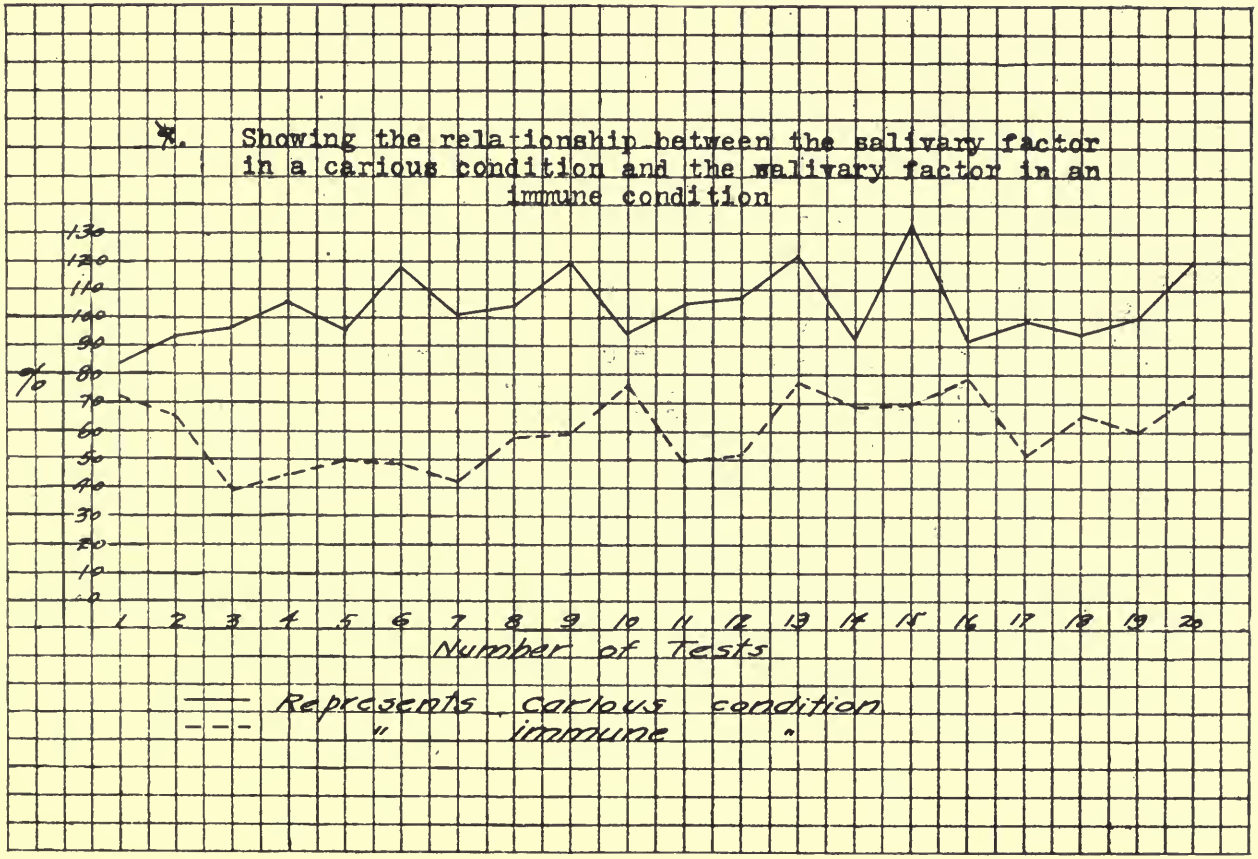
Showing the relationship between the salivary factor in a carious condition and the salivary factor in an immune condition
130
120
110
100
90
80
70
60
50
40
30
20
10
0
%
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Number of Tests
Represents carious condition
" immune "

CHART.

In bacteriological work, the alkalinity of a culture medium may only be varied to a certain degree, depending upon the characteristics of the organism, as well as upon the medium itself. In this way the growth of the bacterium may be inhibited. When this principle is applied to conditions in the mouth, the following theory naturally presents itself.

In the immune conditions, the relationship of the neutralizing power of the normal resting saliva to that of the activated saliva varies within relatively wide limits. In the carious condition, however, the opposite is true, and the relationship varies in relatively narrow limits. This narrow variation in neutralizing power, and the consequent lowered alkalinity, favors bacterial growth, and therefore tends to induce the development of the lactic acid-forming organisms. With this development we find the resultant formation of lactic acid in sufficient strength to act upon the calcium salts of the tooth structure. (See chart.)

Immunity to dental caries, then, may merely mean a *change* in the salivary secretion, which, while not *inhibiting* bacterial growth, yet is not as *favorable* a medium for this development as one having a lower alkalinity, or a narrower variation in relationship of neutralizing power. In the so-called predisposition to caries, this narrow variation obtains, with a consequent increased rate of growth of the organisms.

In conclusion, we have seen that Pickerill's method of determining the alkalinity of the saliva is open to serious objections, on account of the indicator used in the analyses.

2. That patients living on a relatively high carbo-hydrate diet, month in and month out, exhibit no striking difference in alkalinity or acidity of saliva; which is contrary to what might have been expected, judging from the results of Pickerill's work.

Great credit, however, is due Pickerill for the interest his book has stimulated among members of the dental profession. Although his titration methods are at fault, he, and also Gies and his co-workers, are the real, present-day pioneers in this most promising field of bio-chemical endeavor.

Bibliography.

1. Pickerill—Prevention of Dental Caries and Oral Sepsis, 2nd Edition.
2. Sutton—Volumetric Analysis, 10th Edition.
3. Treadwell-Hall—Quantitative Analysis, 3rd Edition.
4. Cohn—Indicators and Test Papers, 2nd Edition.
5. Schimpf—Volumetric Analysis.
6. Kirk—Jour. Allied Societies, June 1914.
7. Marshall—Amer. Jour. Physiol., February, 1915.
8. Marshall—Pac. Coast Dental Gaz., June, 1915.

Papers Presented in Section IV.

Oral Hygiene and Prophylaxis

Opening Address.

By Dr. Herbert L. Wheeler, New York City.

In calling together Section IV of the Panama-Pacific Dental Congress, it is my pleasure to give a very brief survey of what has been accomplished in the field of oral hygiene and prophylaxis up to the present time, and to suggest to this honorable body, the thought that we are in danger of so limiting our activities to the mere brushing and polishing of the teeth that certain other necessary conditions to health and cleanliness may be overlooked.

Mouth Hygiene Defined.

To give a short definition of what the meaning of mouth hygiene and oral prophylaxis may be: Hygiene may be considered as a branch of medical science, which has to do with the preservation of the health. Mouth hygiene might be considered as limiting the subject to the health of the mouth.

Prophylaxis.

Prophylaxis has more to do with mouth conditions and may be considered as a means for the prevention of disease and may be confined to a particular form of disease, so that oral prophylaxis would include such means as might be employed to prevent disease in the mouths of individuals.

To be able to apply oral prophylaxis would necessarily require: First, a knowledge of the pathological conditions or appearances that indicate disease. Second; a knowledge of the necessary measures required to prevent disease.

A careful consideration of these definitions will, I am sure, at once impress you that the present method of simply using polishing implements and powders for cleansing purposes, is entirely too limited a field to be permitted to appropriate the terms "oral prophylaxis" or "mouth hygiene," without protest.

Judging from the history of disease, effective methods of prevention cannot be enforced until a knowledge of the various diseases becomes more complete.

Oral Prophylaxis.

It is apparent then that oral prophylaxis must be extended to include the various procedures which are utilized to combat dental caries and the various diseases of the peridental membrane. We must then

realize that not merely polishing with stick and powder constitute the chief means of oral prophylaxis, but that all service that prevents dental caries, treats the various stages of decay, prevents pulp inflammation and reduces irritation, inflammation and congestion of the mucus membrane and gingival border, constitute an attempt to produce oral prophylaxis to a considerably greater extent than mere polishing. Also the proper treatment and elimination of acute and chronic alveolar abscess; necrosis and carious bone.

You will perceive from this that the idea that it is possible to turn over the service of oral prophylaxis to young women assistants, of little or no training in anatomy, physiology, histology, bacteriology and pathology, is not only absurd and dangerous, it is quite likely to become injurious and even pernicious to the welfare of patients who are practiced upon by these untrained assistants.

When we consider further, that in the mouths of children or young people, under the age of twenty, it is extremely rare to find either salivary calculus or serumal calculus, the ignorant use of a harsh polishing stick and pumice upon the gingival border and about the septum, may cause a great deal of damage and induce the very trouble which ignorant but well intentioned meddlers in oral prophylaxis know nothing of.

We should endeavor to bear in mind that genuine oral prophylaxis consists in having the various operative procedures in the care of the mouth, carried on in their routine place, for each individual, and that each operation should have its proper relation to the other, and all should be supplemented by training the patient in a systematic plan for cleansing the mouth.

In a majority of cases the maintenance of a healthy condition in the mouth, is impossible, unless regular dental operations are carried on in conjunction with the so-called prophylactic treatment.

Scouring and cleaning should not extend farther than the surface of the enamel and denuded root surfaces. The slogan "clean teeth do not decay" is a half truth and as such, has probably been of greater injury than help, to the cause of mouth hygiene.

It must be remembered that the keeping clean of the surfaces of the teeth, in an individual, depends largely upon the tendency to immunity or susceptibility in that individual. Those who are largely immune need no treatment whatever, in fact in such cases, treatment might prove to be pernicious. Those who are susceptible need attention at various periods and it is an uncommonly wise, observing and careful dentist who can designate correctly, at exactly what periods prophylactic treatment should be had. Some might require attention daily, some weekly, some

monthly, some yearly, and some not at all. This being the case, it is apparent that the wholesale application of this alleged prophylactic work, without regard to the requirements in the mouths of specified patients, may become not only an injury but an economic waste of both time and money.

Prophylaxis and Dental Caries.

One thing is evident; in spite of the promises of the enthusiasts, regularly monthly cleanings will not prevent dental caries in the mouths of most patients.

Dr. G. V. Black, in his recent book on *"Special Dental Pathology"* says: "In the prevention of caries, we have only the beginnings in enamel and surface spreading on enamel to deal with. We are not concerned with the caries of dentin. We know from our studies of pathology that there are three groups into which we may place practically all beginnings of caries: (1) Decays occurring in defects in the enamel. (2 Decays occurring in the proximal surfaces of the teeth. (3) Decays occurring in the gingival third of buccal, labial and occasionally lingual surfaces.

"In the first of these, were it not for the defects, the surfaces would be kept clean by mastication and any amount of thorough cleansing could not be expected to prevent the progress of caries.

"In the second of these, whatever treatment is undertaken, care is necessary that the septal tissue be not injured, as injury here is liable to result in recession.

"In the third, most surfaces can be effectively reached by the intelligent use of the tooth brush, and treatment on the part of the dentist, any less often than daily, without the co-operation of the patient, will not prevent the trouble."

Under these circumstances, what is needed in the so-called field of oral hygiene, is not so much the application of a blindly followed system of tooth polishing, as an intelligent knowledge of the etiology of the various dental disorders and a discriminating ability to treat each according to its special requirements.

If the meetings of Section IV of the Panama-Pacific Dental Congress, shall have contributed to a greater knowledge of the conditions requiring prophylactic treatment and of the measures necessary to apply such treatment, the time expended in the meetings of our Section, will not have been in vain.

Dentistry in Public Institutions (Insane).

By Frederick A. Keyes, D.M.D., Boston, Mass.
Past Visiting Dentist, St. Vincent's Orphanage, Boston, Mass.; Visiting Dentist, Medfield State Hospital, Medfield, Mass.

Dental improvements in public institutions necessarily follow medical and surgical progress. Indeed, in the care of the insane, progress has been slow in all three directions. Asylums for the insane were first established in Europe between 1810 and 1820. Previous to this time the idea of isolating patients suffering from mental diseases was developed to a very small degree in private sanitariums.

Asylums for the Insane.

In 1810 the conditions existing in the insane hospitals in Europe were to us of the present day barbaric. A fair idea of these conditions has been given in *"Hard-Cash,"* by Charles Reade. This author exposes some of the most cruel methods imaginable in restraining insane patients in English asylums. His exposure of these conditions aided a great deal in the education of the public, showing them the brutal conditions existing in the insane hospitals of that time. A brief glance at the history of these asylums since then will show the marked advance in the treatment of insanity.

The McLean Asylum, chartered as a part of the Massachusetts General Hospital in 1811, and opened in 1818, according to Dr. Folsom's historical review, "marks an important era in the history of mental disease in this country." It established the character and principles of treatment which have become universal with us. Dr. Luther V. Bell wrote in 1840 that "the application of the severe measures reported as discarded at Hanwell never was heard of in our asylums." Dr. Folsom has shown in his writing that since 1860 America has led the world in her humane care of the insane. In the United States, insanity as a science has received great aid from the works of such able men as Wyman, Bell, Ray, Jelley, etc. These men advanced beyond their predecessors particularly in emphasizing the great need of attendants educated along this special line of nursing. Since the insane hospital has been established under the

control of the State, conditions have gradually improved, until at the present time we are far in advance of any country in the world in the scientific and humane treatment of our mentally diseased brothers and sisters. The psychiatric treatment of our insane is thoroughly investigated; each individual case is studied, and all modern methods of alleviating the mental conditions are patiently tried. With the exception of dietetics and hygiene however, there has been very little advance in the physical treatment of these patients. At present in many of the insane institutions in Massachusetts there are very meagre facilities for even the simplest surgical care. However, in Boston an appropriation has just been made for a one million dollar hospital for the insane. In this institution there will be greater facilities for medical and surgical treatment, and in connection with these, dentistry must be given the consideration which its great importance demands.

Dentistry in Insane Asylums.

Twelve of the insane hospitals in Massachusetts now have visiting dentists, who spend on an average one morning a week in the treatment of the patients. Now information to the effect that the patients' teeth in a certain institution are being given careful treatment by Dr. Smith, who gives so much of his time per week for consideration in doing this work, is very convincing to the unsuspecting friends and relatives, who fondly believe that the patients are receiving all necessary dental treatment. But in the writer's personal talks with several of these visiting dentists, they candidly admitted the absurdity of this belief and stated that the time which they give is spent only in doing the most urgent emergency work. They also state that this fact has been reported by them to superintendents, but, because of the increased appropriation needed to do dental work thoroughly, no improvement in dental conditions is possible.

In order to help these visiting dentists in public insane hospitals in their efforts to convince the State authorities of the futility of the present method of doing dentistry in these institutions, I accepted an appointment as visiting dentist gratuitously at the Medfield Sate Hospital in February, 1915.* For five years this institution has employed a very capable and efficient dentist one morning a week; in fact, it boasts of being one of the first to establish a dental infirmary and to employ a dentist to work. This dentist, like many others in the same position, has often in the past indicated how impossible it is for one man, spending a

*This is a hospital for the chronic insane, the largest of its kind in Massachusetts, at present caring for 1,697 patients.

limited time, to treat adequately the 1,700 patients at this hospital. Seeing no hope of betterment, however, he has continued doing his best, waiting anxiously for the time when dental improvement would be practicable. Below is published my first report to the Board of Trustees of this hospital:

First Report.

Trustees of Medfield State Hospital.

Gentlemen:

I wish to submit for your consideration a report of the oral conditions at present existing among the inmates of the Medfield State Hospital. I have just finished a careful compilation of the mouth conditions of the 1,700 patients; these I have tabulated on a dental card index system, and have thus established a fundamental basis from which future dental work may be chosen and done. It is my plan to keep the chart of the above examination of each patient's mouth on permanent record. By this means it will be very easy to select the cases that are in need of immediate attention. The same cards used for examination may be used also to record the dental work done at any future date; thus, after a year, it will be a very easy matter to refer to these cards and tabulate the original condition existing on examination and the final condition present after dental work has been done.

The time spent in the examination of patients was approximately thirty hours. The method was similar to that used by me in the past in institutions for children, for example: Dental pads were used for the examination and marked with lead pencil. A nurse wrote the name of the patient and ward, passed the chart to my assistant† (a dentist who kindly volunteered his services in this work); I examined the mouth of the patient, using tongue depressors to obtain a clear field, and dictated the conditions I observed through the dentist above referred to, who marked it down as per dictation. As soon as the examination was completed in one patient, I discarded the mouth stick and passed to the next patient, whose name had already been written by the nurse and passed to my assistant, ready to tabulate. In this manner a thorough examination was made with the least consumption of time.

Tooth Brushing by the Insane.

Besides observing the dental conditions, I attempted to find out from each patient his desire regarding his teeth; that is, whether or not he desired false plates, tooth brushes, teeth cleaned, filled, etc. Contrary to expectations, very few of the patients

†I am indebted to Dr. Harold Hoye, of Belmont, Mass., for his assistance given in examination of patients, without which I should have been greatly inconvenienced.

refused examination. Those who refused at first generally submitted after more or less persuasion. In fact, I would state that only about one per cent. of the patients were so unruly as to prevent inspection of their mouths. On my first trip through the wards I interviewed each supervisor regarding the number of tooth brushes in said ward, and, much to my surprise, I found that in the whole institution there were no more than six brushes. This was in spite of the fact that many, of their own volition asked that they be given brushes. Of those whom we asked if they wished for brushes the majority assented. When I first suggested that brushes be supplied, the objection was made that the patients could not be trusted with them, and it would necessitate too many attendants to see that they used them. I found, however, that the few who did possess brushes were faithfully using them. To my mind, the most vital need at the Medfield Hospital at present is tooth brushes and tooth powder, with the enforced use of the same.

In examining patients in the workshop where brooms, shoe brushes, etc., were being made, it occurred to me that, after the initial supply of tooth brushes to the institution, which is urgent at present, the demand for new tooth brushes could be met by this department.

Extraction.

The number of roots and teeth needing extraction was great. This work should be done at once. Many of the patients were suffering from acute alveolar abscesses and swollen, painful teeth. The extraction of all of these teeth is urgent and should be done at once. I would respectfully suggest that in doing this work, pain could be eliminated and work facilitated by the employment of anesthetics, chiefly the dental anesthetic nitrous oxide and oxygen and somnoform. To do this work without an anesthetic, to my mind, would be an injustice to the patients and an interference with the efficiency of the dental work.

Pyorrhea.

Pyorrhea is very prevalent. I would estimate that over 75 per cent. of the pyorrhea is found in the women's wards. The low percentage in the men's department I attribute to the habit of chewing tobacco, which tends to increase the flow of saliva, exercises the jaws and teeth, and to a certain extent acts as a cleaning agent and also as an antiseptic. Within the last week I have been informed that the physicians have been instructed to examine the patients at the hospital for pyorrhea, and also to isolate the amœba buccalis and P. F. and to treat said cases with emetin or ipecac, or one of its various derivatives. I appreciate that the impulse behind these instructions was of the best; but for physicians

to try to diagnose, differentiate and specify the cases needing immediate attention would be futile. Physicians are incompetent to do this work; it is within the province of dentistry, and no man, with the exception of a skilled stomotologist, is capable of judging what cases are in dire need of attention. Moreover, the treatment for pyorrhea without the scaling of the teeth by a dentist would prove of no advantage; therefore, I suggest that if this work is to be continued the dentist should be consulted as the one more likely to obtain satisfactory results.

Cavities.

Cavities in the teeth were surprisingly few in number, due, probably, to the fact that the teeth with cavities have either been extracted or have decayed to such an extent that nothing remains but the roots. The number of cavities in the teeth is one of the least urgent of all dental conditions found. In the examinations in the women's wards there are a great many who are edentulous; if they have any teeth they consist usually of four or five elongated, dirty structures of absolutely no use for mastication. I respectfully suggest that these women, unable to chew their food, should be furnished with artificial dentures. In broaching this subject I was at first informed that it would be impossible to trust these patients with artificial teeth; but I found in the mouths of some of the most violent patients ill-fitting plates that were being worn and used to good advantage, and were, moreover, in good, clean condition. The cleaning of the teeth by the dentist I consider least urgent of all.

If the patients themselves could be instructed and encouraged in the use of the tooth brush, cleaning by the dentist would not be necessary. There were exactly two mouths out of the 1,700 examined that were not in need of cleaning. (Cleaning of the teeth should be distinguished from scaling for pyorrhea, which in most cases needs immediate attention.)

I am very sorry that I cannot at this time present to the Board of Trustees a more accurate tabulation of these conditions, owing to the great amount of time needed to recopy the original blanks and to tabulate the individual amount of roots, cavities, etc. It is impossible for me in such a short time to give these statistics. The above report is a general, hasty review of conditions observed, and is presented with the hope that immediate action may be taken to remedy some of the defects found at the Medfield State Hospital.

Resident Dentist Needed.

In order to accomplish any results which would be of advantage to the patients at Medfield, I consider that a resident dentist, under the supervision of a visiting dentist, would be ideal; but I am doubtful whether it would be possible to obtain a dentist

who would be willing to take this position. Nevertheless, I would suggest that all methods of obtaining a young dentist to act in this capacity be tried. Until such time, I feel that the urgency of the work demands the services of two dentists from two to three mornings a week. For one dentist to handle the situation at present existing would be an almost impossible task. Inasmuch as the work will consist for some time in the extraction of teeth under anesthetics, I feel that two dentists working together one morning could accomplish ten times as much as one working alone.

Respectfully submitted,

FREDERICK A. KEYES, D.M.D., Visiting Dentist.

March 31, 1915.

Second Report.

Trustees, Medfield State Hospital.

Gentlemen:

In my first report I pointed out to you the need of immediate dental work at the Medfield State Hospital. Since that time I have noted with pleasure that the Superintendent and Trustees are giving the matter their serious consideration. In fact, the Superintendent, Dr. French, has already promised to act upon my suggestion to furnish inmates with tooth brushes, and I feel confident that with his co-operation many of the other defects will be speedily remedied.

The appropriation of $30,000 which has been granted by the State to build a new hospital for medical, surgical and dental treatment will do much to help us in this work; but I feel that to postpone dental treatment until this building is completed would be most unjust to those who are at present suffering acutely from need of dental treatment. To my mind, a modern dental infirmary could be temporarily established and work begun at once. I realize the dire need of surgical and medical care; nevertheless, I see no reason why there should be delay in doing work which is obviously so necessary, as will be seen from the statistics published below:

Total number of patients examined	1,697
No. of cases of pyorrhea	330—20%
No. of patients needing extractions	680—40%
No. of acute alveolar abscesses	72— 4%
No. of patients with carious teeth needing filling	150— 8.9%
No. of patients in need of full upper and lower dentures	270—15.9%

No. of patients in need of full upper dentures	201—11.7%
No. of patients in need of full lower dentures	30— 1.2%
No. of patients resisting examination	28— 1.1%
No. of patients wearing plates	40— 2.3%
No. of cases of stomatitis	30— 1.2%
No. of cases of cleft palate	1—
No. of cases of hair lip	1—
No. of cases needing cleaning	1,695—99.9%

These statistics speak for themselves. Items 1 and 2 alone plead more eloquently for immediate attention than any words of mine.

At present the dental equipment at the hospital is insufficient and practically useless. I feel quite confident, however, that an infirmary could be established at very little cost other than the initial expense of new paraphernalia, which would be inevitable, and can be easily transferred when the new hospital is built. Therefore, I can see no reason why there should be any further hesitation in deciding what course to pursue in a matter of so vital importance to the comfort and well-being of the patients.

Respectfully submitted,

FREDERICK A. KEYES, D.M.D., Visiting Dentist.

April 30, 1915.

These are the conditions existing in one of our Massachusetts hospitals. According to the report of the Mass. State Board of Insanity for 1913-14, the total number of insane under care of this State on October 1, 1913, was 17,049, or one to every 210 of the estimated population of the State. Of this number, 13,760, or 81 per cent., were insane; 2,406, or 14 per cent. feeble-minded; 649, or 4 per cent., epileptic (sane), and 159, or 1 per cent., inebriates. Their increase for the year was 542. Of this number, 401, or 74 per cent., were insane; 177, or 33 per cent., feeble-minded, and 50, or 9 per cent., epileptic (sane). The whole number of such persons under public care was 16,608; under private care, 441. The whole number of such persons in public institutions was 16,020; their increase for the year, 513; their average annual increase for the last five years, 629.

If the conditions above presented to the Trustees of the Medfield State Hospital are indicative of similar conditions existing among the 17,000 insane in Massachusetts, it is obviously logical that some measures should be taken immediately to improve the oral conditions of the inmates under State care. There is at present great agitation as to the proper diet

each patient should receive; the amount and quality of food to be given is rigidly supervised, and nothing but the best food is used. It is surely inconsistent to expect the greatest nourishment from food if the patients, as above recorded, are without teeth to masticate it. Patients with active cases of pyorrhea, incipient abscesses, exposed pulps, etc., will certainly not obtain the caloric value from their food which the amount given indicates. The physical ailments of the thousands of inmates in our public institutions which are traceable to the teeth are too well known for me to enlarge upon them here. The relation of the teeth to mental attacks has also been reported. Are these patients, public charges, to be neglected for want of the necessary appropriation of money? Is it not our duty as dentists to use all means of persuasion, fortified by oral conditions, in these institutions? Should we not demand in the name of all public-spirited citizens that these poor unfortunates be given the benefits of our modern scientific dentistry? If we do not, then it seems to me all our professional humanitarianism has been merely a boast.

Caries in Children's Teeth to Prevent, Retard and Cure.

By Mattie K. Wyman, D.D.S., Seattle, Wash.

In order to actually prevent caries in a child's teeth we shall have to start with the mother, at least, as soon as pregnancy is known to exist. To-day a prospective mother comes to you and asks you what she must eat and what she must do, so that her child may have good sound teeth.

Do you realize that the public is awakening to the fact that sound teeth is the first requisite to good health? What are you going to advise that mother? She feels that her most important duty is to rear a healthy child; and she also feels that the responsibility is greater than her ability.

The Mother's Diet.

Diet, rest and exercise must be considered. The mother must be temperate in all things, and especially in her diet. We learn that the drug or drink influence, added to the autotoxemia derived from the mother's incumbered state, brought on from gluttonizing during pregnancy, is an influence well calculated to alter the functions of the brain to such an extent as to cause in some cases forms of epilepsy and non-development of an isolated brain centre, or part of a centre.

Babies that are nursed by their mothers will have their food supply more or less injured by the effect of the drug used on their mother.

Gluttonizing is sure to produce an incumbered baby, heavy and unwieldy, and such are often injured in handling. They are over-nourished and are very vulnerable to epidemic and endemic influences. Their nervous systems and brains are made very susceptible. These children cause long labors and are liable to suffer injury from drugs and instruments.

Some one has said that three to six pounds is the correct weight at birth, safe for mother and child. Nine to twelve-pound children are liable to be injured.

Children that are previously too well nourished have trouble in teething; the irritation from teeth may throw them into convulsions; indigestion may do the same. Epidemic influences act likewise.

Weather conditions that affect the chemistry of plants must affect also the chemistry of animal and human life; this is shown in epidemic and endemic diseases. Epidemics, however, are becoming more scarce, because the principal causes, ignorance and filth, are being overcome.

The causes of susceptibility are the causes of all epidemic diseases. Children then who have been injured from whatever cause during embryonic or fœtal life, at birth, or during the first years of childhood, are made susceptible. It stands to reason that a child with a sound brain and spinal cord, and in perfect health in every other way, will not be influenced by epidemics.

Again, we learn that we must not overlook the nervous temperament as a predisposing cause of nervous diseases, as this temperament makes it possible for any influences that use up nerve energy to bring on nerve diseases; for instance, any irritation of the nerve centres, either direct or reflex, such as injuries to the brain received in childbirth or in child-life from accident or from teething; gastric or intestinal indigestion, excitement and irritation common to child-life, and last, but not least, drug influences.

To prevent all diseases, a broader moral education will need to be given prospective parents. So long as fathers and mothers believe that generation is something that is governed by chance, and that they have nothing to do with creation, the population of the earth with cripples, both of body and mind, will go on.

Creators must know their responsibility and assume it with the right spirit and not indulge in stimulants of all kinds. In fact, they should be temperate in all things, food and habits.

The father and mother must correct their own mistakes and live clean, normal, temperate lives before they can hope to have normal children.

Disease is always the effect of a broken law. Parents cannot afford to undermine their own vitality.

When a prospective mother asks us for advice about her diet, and the influence it will have on the child, it is our duty to tell her as gently as possible how necessary it is for her to live a normal, happy and active life; to abstain from all stimulants, to eat no heavy foods that are apt to mass and clog up the system; to eat very little if any of the foods overstocked with starch, such as potatoes. In fact, the potato will create more gas and discomfort to the prospective mother than almost any other vegetable, and if tolerated during pregnancy should be prohibited during the first three months of the child's life and thus avoid a "colicy baby." Turnips and cooked cabbage should not be eaten at this latter stage.

Avoid all white bread and heavy pastry. In fact, the latter is good advice to all humankind.

If the patient is troubled with indigestion or "heart-burn," advise a tablespoonful of pure olive oil just at bedtime; a dash of salt will make the oil more palatable for those who cannot take it clear. At least one orange or apple a day is advised, and more if agreeable to the mother, and a dish of prunes every morning at breakfast time.

The prunes should have plenty of juice, using plenty of water to cook them in and not too much sugar. Better have them a little tart than sweet. The rest of the meal may be taken as usual, always avoiding any extremes, however, such as too many starchy vegetables at one meal. Sweet potatoes may be eaten, as they are not so starchy as the Irish potatoes, and bread made from the whole wheat flour is the best; this should be at least a day old. Rye or corn bread may be eaten.

Avoid going to extremes with the fruit diet, thinking that if a little is good, more will be better. Very serious trouble has come from this. We all know that trouble is apt to come with extremes of any kind.

One mother did not like the olive oil and the fruit diet, but took the oil because it certainly relieved that characteristic burning of indigestion, and would take at least one orange a day and one dish of prunes. It was the only "medicine" she was asked to take, and because it relieved her she could not but see its virtue.

All fresh, ripe fruits in their season may be taken, except bananas, strawberries and blackberries; the two latter contain too much uric acid. The vegetables rich in phosphorus are especially advised because of its remarkable influence on the growth of bone; they act also as a nerve tonic. We know that the phosphates are prescribed for children with rickets. How much better to avoid a child mal-nurtured by giving the mother good sound palatable vegetables, possessed with plenty of this bone-building element. This is of special interest to our profession, and must not be thought of too lightly.

Therefore, during gestation advise vegetables as spinach, carrots, lettuce, celery, string beans (never the hard beans), fresh peas and water cress. Eggs, any way but fried; meat once a day, a piece the size of a lamb chop, of beef, mutton, lamb, poultry or game, broiled, baked, boiled and roasted only; crisp bacon and boiled ham. Any food fried should be studiously avoided. Have the meals well balanced in regards carbohydrates and proteins; for when nutrition is crowded by an over-supply of proteid or carbohydrates there will be a clogging in the intestines and systemic infection from the absorption of decomposition in the bowels.

Besides the regular meals taken at regular times, it is advisable to

take a glass of warm malted milk. This may be taken with warm cow's milk or water, half and half; it may be salted slightly or sweetened a little, according to one's taste. A beaten egg may also be added, but taken good and warm, about twenty minutes before bedtime. This will insure a good night's sleep, besides producing splendid nutrition for the natural food for the prospective child. This warm malted milk egg-nog (no spirits are used, of course) is sipped slowly, and there is nothing better to nourish the vitality of the mother and carry her over to the breakfast hour, which is a wise precaution, for we all know that the human vitality is lowest at about four o'clock in the morning.

This diet is advised right through the nursing period of the child. Under normal conditions, the child should not be weaned under one year old. One mother, when her child was six months old, became so tired of her dish of prunes and one orange a day that she discontinued them. The child at once became constipated and she resorted to glycerine suppositories, but upon advice resumed the diet of cooked prunes and fresh fruit, and the child's habits, as well as her own, became established again.

Exercise and Rest.

The most fortunate children in this world are born of mothers who have to do their own housework, or at least a fair share of it. Any mother so over-burdened with wealth that this womanly pleasure has been denied her must take regular exercise. Systematic walking, weeding one's flower beds, or even getting down on all fours and wiping up the floor is advised. Above everything, do not get lazy and gluttonous. Proper and systematic rest must be considered. One must not overwork, but should keep comfortably busy.

We learn that the breast-fed baby has nine more chances of living than has the baby given the bottle. To nurse a child normally, a mother should be strong and healthy, of an even, happy temperament and desirous of nursing her baby, and she should have time to devote herself to this special duty during the whole period of her lactation. She should regulate her diet and her exercise and sleep in any way which will best fit her for the task. The child should never be put to the breast, if for any reason the mother has become overheated.

Having considered the proper nourishment of the embyro and fœtus, we will now consider the care of the baby.

The Care of the Baby's Mouth.

Did you know that almost as soon as the baby has made its first cry that its eyes and mouth are swabbed out with small, soft linen cloths dipped in boracic acid solution? Thus the child gets its first mouth wash. Its little mouth and nose should be

cleaned when given its daily bath. The mouth of the infant should also be wiped out with linen squares, dipped in boracic acid solution, or bicarbonate of soda, twenty parts to the ounce, before and after each feeding, thus avoiding thrush. The child should be fed regularly and nothing allowed in its mouth between times. The mother's nipple should be cleansed before and after feeding the child; also care should be taken that too much force is not used in cleansing the little mouth.

Every tooth of the deciduous set should receive daily attention by the mother or nurse until the child is old enough to use its own brush, and this should be used under the care and direction of the mother, after each meal, until the child has mastered the art and will not slight this task. We know that too often they are neglected altogether, and that dirty teeth will sooner or later become carious; and carious teeth, besides being a cause of bad breath and neuralgia, and even earache, are also a constant menace to the health of children, since they may and do harbor infectious germs of all varieties. Such teeth should receive prompt care.

To Prevent, Arrest and Cure Caries.

We find in *"Prevention of Dental Caries and Oral Sepsis,"* by Dr. Pickerill, that this man, who has devoted much time to research and experiment, has found a diet for children which will actually prevent, arrest and cure caries. This will apply to grown-ups also.

Pickerill tells us of a number of children whom he had under strict observation for two years, and he says caries commences in their teeth no more, and that present has not progressed; that the surface has become quite hard; thus "arrested caries" has been established. The tooth brush is used spasmodically; also that green-stain well established has disappeared.

He claims that salivary depressants tend to lodge and remain in the mouth more than salivary excitants.

We all know that certain articles of diet tend to stick to the teeth, or to leave more débris behind after mastication than others. It is perfectly obvious, therefore, that in a normally shaped mouth if a substance has a high acid potential, but yet does not lodge, it would not be anything like so harmful as another substance which had a low acid potential, but a great tendency to lodge on or between the teeth. The relative lodgeability of foodstuffs is, therefore, a matter of the highest importance, and one in which it is necessary to have some precise information.

Such foods as chocolate, biscuit, pastry, cake, brown bread, toast, white bread, milk, dates, peppermints (containing glucose), cane sugar,

bread and honey, rice, figs, oatmeal cookies, ginger cookies, all have a potential for causing caries, and are considered by Pickerill as salivary depressants, therefore harmful, as they are originally either alkaline or neutral in reaction.

Potatoes, lemons, parsnips, pineapple, banana, apple, orange, meat-beef, fish, duck, etc., are originally acid in reaction, and are therefore beneficial.

Thus he considers foods which are alkaline or neutral in reaction, harmful, because they do not create a sufficient flow of saliva to wash them from the teeth. They stick there and cause caries. While the foods which are acid in reaction are beneficial, because they cause an abundant flow of saliva and this cleans the teeth.

Therefore, in order to prevent the retention of fermentable carbohydrates on and between the teeth, and so eliminate or very considerably reduce the carbohydrate factor in the production of caries, starch and sugar should on no account ever be eaten alone, but should in all cases either be combined with a substance having a distinctly acid taste or they should be followed by such substances as have been shown to have an acid potential, and the best of these are undoubtedly the natural organic acids found in fruits and vegetables.

Dr. Pickerill recommends acid potassium tartrate in a mouth wash. First, because it is an active salivary stimulant. Second, it is a form of acid which is widely distributed in nature, and one, therefore, to which the salivary glands have by the process of evolution been adapted. Third, its solubility is only one in two hundred parts of water, and therefore if it be used in the liquid form there can be no danger of its being used in too strong a solution, either on account of faulty making up or of subsequent evaporation. Fourth, it has an agreeable taste, which may be made more so by the addition of saccharine. This is again an extremely important factor in applying these principles to children. An acid mouth wash keeps the calcium phosphates and carbonates in solution, and thus they do not precipitate upon teeth in form of calculus.

The Dentist and the Child.

Now, a word about the dentist who undertakes the care of children's teeth. If there were as many women dentists as there are men, I should say, send them to the women. Since this is not so, it becomes the duty of every dentist to care for his share of the children.

When the child enters the dentist's office for the first time the parents, if wise, and sometimes they are, have made rather an event of the occasion, and the child knows that he is to be relieved of a troublesome

toothache. The dentist will have a bright and smiling face, and, let me add, that at any time during your work, if your brows unconsciously contract while your eyes are focused on a tiny root canal, and that child's eyes seek yours, it is a signal for the brightest smile you have. Remember, your face is very near the child's and it must not look ugly; such a little thing will frighten some children. With a quick, "I was just scowling at that naughty little 'toothacher'—he made a face at me, but I got him all right. He won't trouble your little tooth again." The child will laugh and be as happy as you please.

With the tactful dentist, the chair is a little elevator; some children are afraid of elevators, so it must be adjusted slowly for such.

It is a good plan to hand the child the mouth mirror and tell it to look at its eye and see how large it is; you have that kind of a mirror to make the "toothachers" look large, so you can catch them; and just here let me add that while you are fishing around with excavators to remove decay, and the child gets impatient, tell him to just wait a second, that you just have that old "toothacher by the left toe." He will want to see the "toothacher;" show him the bit of decay you have on your excavator; it will not fail to satisfy him.

When cleaning root canals the cotton is twisted onto the broach to tangle up the toes of the "toothachers," for you catch them in that way. When cleansing out a putrescent pulp, let them get a whiff of it, and as a rule they are more than anxious to let you cleanse it thoroughly, to get out the last vestige of anything that might have "crawled in." It might have been a pussy cat. Never forget that a child has a wonderfully vivid imagination, and these things are not lies to a child. They are just make-believe, and yet seem half real, and the child's mind is at work with a dozen questions to ask you. Be ready for them, all in the make-believe language.

Now for the dreaded engine. You are in luck if the child has never had it used before he comes to you; for you will be wise enough to select a tooth that will not hurt when the engine is first used. Then you will ask the child if he has ever heard the buzzing of a wee honey bee among the flowers; tell how the bee gets the honey and how his legs gets full of pollen, because they are fuzzy and the pollen sticks to them. Then ask the child to listen to the funny noise that this little busy bee makes, and see if it does not sound like the bee in the flower. Invariably they will laugh at the buzzing of the bur, and you will have no trouble. Do not bur long at a time and use the bulb syringe often. The bur with its twists and turns represents the fuzzy legs of the bee and catches all the naughty toothachers and puts them to rout. The

bulb syringe washes them out and they go into the cuspidor and thence into the Sound, and if the fishes don't watch out and keep their mouths clean they will get those toothachers.

Don't think for one second that their little minds are not active. One little girl, when she heard the story of the bee, promptly asked, "Will it sting?" You can answer in the negative if you are careful and draw the bur away from the pulp. Always have the burs sharp; in fact, all cutting instruments should be sharpened as soon as taken from the sterilizer. Instruct your assistants how to sharpen them and insist that every cutting instrument receives its even, sharp edge before being replaced in the cabinet.

The story sometimes is about "little Mikes" or "Germans" (microbes and germs, respectively). A child was told about these tiny "bugs" and how they make the teeth ache, etc. While removing the pulp from a root canal for this little Miss she caught a glimpse of it and exclaimed, "Why, that isn't a bug—that's a worm." As a rule, it is best to keep all pulp tissues out of sight of your patients, young or old.

Remember this, that the average children see about twice as much as the grown-ups; they know when you wash your hands; they know if you drop an instrument and use it on them again without first cleansing it. They know if you are clean and attractive looking.

Do not make a mystery of anything you do for the child—do everything naturally. If you are going to lance the child's abscessed gum, you place your cotton rolls conveniently to catch the pus and blood; your sterilized lance is dipped into 95 per cent. carbolic, then into alcohol, the back of it just touched to some absorbent cotton to catch any excess alcohol. You do all this naturally and make a quick incision. Usually the child gives a quick little "Oh!" and with an "Oh, did I stick your gum a little? Well, never mind, we will be a little more careful another time," it is over. With one little boy, whose gums were bleeding freely, he was told that if he would watch he would see the toothachers coming out with little red sweaters on. Now that child knew that that which he saw was blood, but the red sweater idea struck his fancy, and he at once said, "Oh, I saw a whole bunch of them with red sweaters on." When his mother returned from her shopping to get her son, she was told about the red-sweatered toothachers, and on explaining she very quietly said he had always been deathly afraid of the sight of blood.

Parents.

And just here a word about parents. A wise mother will select a dentist in whom she has all confidence; then she will leave her child and do her shopping and call for that child when the hour is up. A child will look

for sympathy from a present mother, and if there is no one there he never thinks of it. He is told what a brave little man he is. Children like to be told they are brave, and it *makes* them brave. I have seen the big tears roll down their cheeks when they were hurt, but never a whimper. Commend their bravery; never see their tears; they are often ashamed of them. Do not let them see your sympathy until it is all over, then you can take them in your arms and tell them that you just had to take out every tiny speck of decay and rout every toothacher; that if you left the slightest speck under the filling it would multiply and grow and try to get out, and thus make the tooth ache more than ever. They will usually say they knew you didn't mean to hurt them, and will snuggle close in your arms a few minutes, when some bright, happy thought will come to them, and they are down and ready to go as soon as their mother calls for them. Don't forget to tell the mother *before the child* how brave he has been.

Brushing Children's Teeth.

A word about the brushing of their teeth. If a child is not suffering with the toothache at the first visit, thoroughly clean his teeth. He is asked to look at them before and after; then asked about his brush; if too old and soft, his mother is advised to get a new and stiff one. If it can be hung near heat or in the sun to keep dry and stiff, so much the better. He must have his own little tube of paste or box of powder, and have it where he can reach it. Watch those teeth, and if he is neglecting them have a little talk with the child. If it is a girl, ask her if she has ever set the table for her mother. Of course she has. "Well, I am surprised that you put dirty knives and forks and spoons on your table to eat with. They haven't been washed since the last meal." This will make her indignant, and she will justly deny the charge that her mother ever would allow knives and forks to be used from one meal to the other without having first been washed. "Well! well! well! Then, my little lady, what right have you to allow these little ivory knives and forks and spoons (for that is what your teeth are to your tongue) to come before your tongue at dinner time when you haven't washed them since breakfast? They must be washed after every meal. Poor, sad little tongue; no wonder she blushes so when I see her surrounded with all those dirty little knives and forks." This will usually take. But, of course, little children are told time and again by their parents to wash their face and hands. Those same parents should remember about the teeth, too, for children are forgetful.

If the child is a boy, and he is interested in engines or machinery, and what boy is not? ask him if he has ever noticed the engineer polish-

ing and oiling and rubbing up, making shining and clean all parts of the engine. Ask what he thinks it is for. Of course, it is to keep it clean and free from grime and stickiness, so it will run. There is his lesson, he must keep his teeth brushed and free from food and thus free from cavities, so that his breath will be sweet and clean, and so that his whole system will "run" properly.

A young girl who is careless about brushing her teeth is told about a young man you know who was quite disgusted with a very pretty young girl because she was careless about brushing her teeth, and *vice versa*. It works. They may not have been enlightened as to the fact that to-day young people are expected to have glistening teeth, as well as polished finger nails.

It is not necessary to make a play-room of your office, yet to allow a child to squeeze out the bulb syringe into the cuspidor, as a reward for being still, or even to hold the handpiece of the engine and push the controller with his foot, occasionally might win you a little child who would rather go to the dentist's than to a party. I have heard of such.

There are just two kinds of dentists who should never work for a child, and those are the man or woman who does not love children, or one who is too nervous to have patience with them. They are grateful and lovable little creatures, and should not be frightened, and this kind of a dentist will frighten them and make them unfit for others to do work for them until they have, by wonderful tact and patience, won their confidence. If you do love children and have patience with them, do not send them to anyone else. Remember that children grow up in a remarkably few years, and if you send them to another dentist, prepare to lose their fathers and mothers, for if a dentist is kind, patient and gentle with a child, the father and mother will want that dentist themselves. For all people are more or less childish when they think they are going to be hurt.

You will make no headway by forcing a child. Perhaps just a look into their mouths is as far as one can get the first time. Next time, be assured, you will be able to do more. Never keep them long enough to tire them. Let them wiggle as much as they wish, while you are not actually at work in their mouths. They will thus get the wiggles out and will be quiet as mice while you are working for them. Keep sweet, no matter how provoking the child is; thus you will win out. Most of them are comparatively easy to get on with. Allow no one in the operating room but yourself and your assistant. It is not necessary to bribe a child, but never make a promise that you do not intend to keep.

Children, as well as grown people, should come to their dentist at

least twice a year and have their teeth thoroughly cleaned. Where this rule is not followed, that dentist is neglecting his patients. They like you to call them up and notify them, or drop them a little note. I do not see how a dentist can find all the cavities unless he does clean the teeth of every patient thoroughly.

Management of Difficult Cases.

Now to cite a few complicated cases and tell what was done for them:

A—is a little girl just four and a half. Her mother never dreamed that the child needed dental care until she complained about eating solid food. Her mouth was examined and the mother brought her to the dentist at once. The little right upper molars were badly decayed; food had crowded between these teeth and the child had refused to chew on that side. The result was the gums were nearly purple and swollen so badly as to nearly cover the molars. Several of the cavities contained hypertrophied gum, and what little there was left of the teeth was covered by a dense coating of calculus. The child was truly anxious to be relieved, so the teeth were thoroughly cleaned at that sitting and twenty-four cavities were unearthed. (A mild solution of Lavoris was recommended in this case.) This made along sitting, but it seemed necessary for the child's relief. The consequence was that at the next sitting the child was more unruly, but by making this sitting short and using a little tact much of the hypertrophied gum was removed from each cavity by trichloracetic acid. This was done by winding cotton around a blunt instrument and dipping this in the acid and applying this to the gum tissue with slight pressure. This is very effective in shrinking swollen gum tissue, but care must be taken to protect the surrounding parts with cotton rolls and to thoroughly cleanse the surrounding surface frequently with quite warm water from the bulb syringe. You can usually pack in a gutta-percha filling when this is done. This is left two or three days and then the cavity is free from all gum tissue and can be properly cared for.

Upon removing the caries in this case it was discovered that four of the molars had exposed pulps. These were treated, one at a time, with arsenical fiber; Dr. J. P. Buckley's formula was used. This was left in from 24 to 48 hours, and the devitalized pulp was removed with a barbed broach, and the canals cleansed with cotton wrapped in a smooth broach; this is dipped in peroxide, but not used too moist. If for any reason there is a doubt about the pulp being thoroughly removed, the barbed broach is used until every shred is removed. A dressing of paste, made from zinc oxide and oil of cloves, is placed in

each canal, and the cavity sealed with gutta-percha, care being taken to make the paste rather thin. If too thick the cotton sticks and is not easily removed at the next sitting The canals are wiped out with eucalyptol and dried, and gutta-percha canal points are fitted and placed and a silver or copper amalgam filling is placed, as the cavity indicates. Where the gingival margin of the cavity extends under the gum, or the cavity is very shallow, copper amalgam is best. One may fill the lower part of the cavity with copper amalgam and the occlusal half with silver. The copper amalgam is the best filling material for children's teeth. It is very easily manipulated and is very tenacious. When placed, these fillings are polished at a subsequent sitting. Their only objection is their dark color, but a parent will not object to this when told that the copper tends to preserve the tooth substance and that only the deciduous teeth are filled with copper fillings.

Case II. Patient *B.*—is a child of seven years, and an older sister of A's. The few anterior temporary teeth she had remaining were not touched, except the upper cuspids. These would remain with the child until she was twelve years old, so the decay was removed and a white copper cement placed in the cavities. All of her temporary molars were abscessed, and the child has suffered considerably with toothache. In the upper teeth the buccal pulps were putrescent, while the lingual pulps were alive. In the lowers the mesio-buccal pulps were putrescent and the distal pulps were alive, but very much inflamed. The putrescent canals were cleansed, first by absorbing all the pus possible with cotton on a smooth broach and then with peroxide, followed with alcohol; a cotton dressing dipped in Black's 1-2 and 3 was left in these canals, and a pledget of cotton dipped in the same was placed over the live pulp and the whole sealed in with gutta-percha. This was done with each tooth, treating but one at a sitting, of course. In three or four days the treatment was removed and the canals cleansed and a dressing of paste placed in them with a tiny speck of arsenic fiber placed over the live pulp, care being taken in sealing to cover the buccal well, first with a drop of calxine, and then the cavity was filled with this cement and left twenty-four hours. Then the pulp was removed, the canals cleansed and a paste dressing placed and a cement filling made, and that tooth was allowed to rest a week. It is safe to leave several weeks. In this case it was left until all the other seven molars were treated in the same way; thus one at a time these dressings were removed and the root canals filled in the usual way and silver fillings placed.

Both of these children, suffering as they did from toothache, their

inability to masticate properly, and the drain on their system which this made, along with the absorption of pus, were thin and anæmic and extremely nervous. They were placed on a strict diet, and in a few weeks' time they gained weight and were round and rosy and had forgotten all about nerves. Their mother is extremely grateful and insists upon bringing them in every two months to have their teeth examined, and the children love to come. Their nervousness disappeared as soon as the relief from pain was established.

Case III. *C.* is a little maid of three summers, and the labial surface of her upper incisors contained broad carious cavities; these were burred out and filled with white copper cement. The caries in the laterals were not so deep, so a sand-paper disk was used to smooth them as much as possible. At the very centre a spot of the caries refused to be disked off, so a rubber dam was slipped over these teeth and a saturate solution of silver nitrate was applied and exposed to the light for 15 to 20 minutes, and then the dam was removed.

This child did not return to the office for a year and a half. The mother claimed to take good care of the child's teeth, but was not particular about the child's diet. She said the cement fillings washed gradually away, and was out altogether in three months. Shortly after that she was visiting her home and the child's uncle, a dentist, placed cement fillings which lasted about four months. When the child came for this sitting she was four and a half years old, and had developed seventeen cavities, besides the four in the upper incisors. They were all small pit cavities, however, except one where the pulp was exposed. This was devitalized and removed. The fillings in the molars were made of silver, but the broad shallow cavities of the incisors were filled with copper amalgam. They are black, of course, but they have stayed now nearly a year and show every indication of remaining until she sheds the teeth. This child had also developed a very decided case of enlarged tonsils, so the mother was referred to a competent specialist and this was corrected.

Case IV. *D.* is a small boy two and a half years old. The crowns of the upper incisors were gone, and just little black stubs of roots protruded from the gums. These roots were all abscessed. The pus was absorbed out and the canals cleansed and a paste dressing placed in them and cement flowed over the end. One root was cared for at a sitting. They responded beautifully to the treatment and root canal points were inserted at a subsequent sitting, and copper amalgam placed in the enlarged part of the canal and brought over the end of the root. When the tissue

around the apex of a root is relieved of all irritation, and is reduced to a normal condition, the absorption of the root will go on in a normal way, leaving the soft gutta-percha points entirely exposed. They are so soft that the gum tissue is not harmed.

Case U. *E.* is a boy of six years, and was sent to the office by his physician. His mother took him to the physician because the child would not eat solid food and would drink only cold milk and water. His mouth was certainly in a deplorable condition. Septic conditions were feared, and in fact it was a clear case of ulcerative stomatitis, with eczema of the tongue. The breath was offensive, the free margins of the gums were red and swollen and bled on the slightest touch; ulcers appeared along the gum margins of the upper and lower jaw. The base of the ulcers was a firmly adherent grayish white membrane and the edge of the alveolus around the upper incisors was necrosed and the teeth loose. The mouth was hot and painful, and saliva flowed freely, the glands were swollen and the lips puffed out. The child's face was waxy white, the tongue was heavily coated except on the characteristic irregular shaped patches, where the outer epithelium had sloughed off entirely, leaving the patches raw and tender. These patches and the ulcers on the gums were touched up with silver nitrate several times, and Lavoris, diluted about half, was ordered as a mouth wash to be used three times a day. The zinc chloride in Lavoris is very beneficial in this condition, and the children like the taste of Lavoris. Fresh air and a special diet was prescribed, and proper elimination looked after. As soon as possible he was allowed to chew gum; this pleased him, and soon he was again enjoying solid food.

Not a tooth in the child's mouth was free from decay, but it was of the black variety, slow in action. The first permanent molars were present, but had not erupted. At the first sitting he received a thorough prophylaxis treatment; then the ulcers and patches were cared for as stated, and the upper centrals and one lateral flipped out; the ends of these roots were as round and smooth as if they had been disked and polished, and were very stubby and black and did not have the irregular appearance of a normally absorbed root. The remaining lateral seemed a little firmer, so this was treated and it tightened up and is giving good service. It was perfectly wonderful to see how responsive to treatment every part of that little mouth was. And as the conditions grew better the boy became rosy and gained in weight.

The two lower second molars were in a putrescent condition and had abscessed and the mesio-buccal roots were laid bare. After the teeth were cleansed and treated and filled, these gum cavities were cleansed

with peroxide and syringed out, and every particle of food removed. Then tiny strips of iodoform gauze were packed in. These were changed every other day, and in two weeks' time the cellular growth had closed up these sinuses, and the expectation is that those little roots will absorb normally.

The cavities where the pulpal wall was very thin were filled with copper amalgam, the others with silver. The history of the eruption of this boy's teeth is unusual. He was fifteen months old before he had a sign of a tooth, and then the upper laterals were first to appear. The child was breast fed.

A history of the family showed a syphilitic taint. These unfortunate children must be carefully watched at the time of teething, and especially at the eruption of their permanent teeth; then again at puberty they should be under the watchful care of a physician and a dentist. Their deciduous teeth usually seem normal, except that they seem to appear very late and are prone to decay early, but usually it is the very dark, slow decay.

In teeth where the roots are partially absorbed, or the floor of the pulp chamber has decayed through and the tooth has not reached its time of shedding, either iodoform or aristol powder is mixed in melted paraffin, and this is pressed into the cleansed, dried floor of the pulp chamber and as much as will is allowed to enter the canals, then a copper filling is placed. This will often tide a tooth over and hold the space until the permanent tooth appears. The contact point in the molars is always striven for, and sometimes the contact point of the deciduous incisors, where they seem crowded and Nature has not done her duty in spreading them at the proper time, which should be brought on by the growth of the maxilla.

Each sitting lasted from twenty minutes to one hour, never over, according to the case in hand. All fillings are polished, whether silver, copper, amalgam or cement; even gutta-percha fillings are made smooth by wiping them with a pledget or cotton dipped in eucalyptol.

Now, my sister and brother dentists, you may feel that much of the advice in the early part of this paper should fall on the physician only. Should it? Have they not challenged the dental profession by saying that it is up to us to continue this fight of germs and micro-organisms; to make new discoveries, etc.; that they have gone as far as they can? Are we, as dentists and members of a profession every whit as noble as the physicians, going to let it pass, and thus lose our opportunity? There is, I believe, a rumor of a few dentists who have retired from active practice. They have amassed a fortune (I wish they would

tell the rest of us how they did it). Others have married wealth, some have inherited theirs. To these I make my plea. In the name of humanity, if you got your start in our noble profession, use some of that wealth that has come to you in research work, experiments, etc. Get back into the field again and make a name for yourself and our profession, and thus do something with that wealth that the good Lord has allowed you to have. It was never given you so that you could lay down your oars and just enjoy living. Don't you see the secret of the rich man's inability to enter Heaven?

The honorable accumulation of wealth is just and commendable, *but* the disposal of your wealth and your talents will one day be demanded of you. I say talents advisedly, for many who have not wealth have at least brains; please do not laugh and say you have not. You would not let another man say that of you. Oh! I beg that you will use them! Never let an opportunity slip to write a paper when you are asked by the program committee or your society to do so. If you are asked to take an active part in your society, do not decline. Take these opportunities and use your brains. You may surprise yourself and everyone else. When you are asked to write a paper, treat it as a high privilege, accept it at once, before you can think of an excuse of any kind. Read everything that deals on your subject that you can lay your hands on. Then draw from your own practice and experience and write a paper that is as original as you can make it. This is what others need; you may by experimental work or research fall upon a combination of causes and effects that will lead to a most important discovery which may prove a great boom to humanity.

The Combined Agencies in Ohio Co-Operating in a General Oral Hygiene Educational Campaign.

By Homer C. Brown, D.D.S., Columbus, Ohio.

Introductory.

In any progressive educational movement, especially one wherein the health and happiness of the public is involved, it must be recognized that a persistent and continued campaign is necessary in order to accomplish anything like satisfactory results.

In this conection, observing dentists have long recognized the prevalence of pathological oral conditions, especially dental caries, and by such a campaign they have finally succeeded in directing attention, in a more or less general way, to this prevalence. This campaign, which has had the co-operation of some of the progressive physicians, has demonstrated beyond doubt that favorable or unfavorable oral conditions bear their proportionate relationship to all parts of the body and necessarily add to or detract from the general efficiency of the individual.

This is quite different from the views generally accepted only a few years ago, when the teeth and their contiguous tissues were scarcely considered as integral parts of the body, and therefore were not reckoned and when diagnosing or treating a disease in other or remote locations, or to any appreciable extent when in the immediate or adjacent field. To-day we find the physician, the specialist and the surgeon directing attention to the teeth as the probable source of infection in many diseases of obscure origin. This is particularly true of diseases located in the regions supplied by the fifth nerve, diseases of the alimentary tract and in so-called rheumatic and associated disturbances.

The development, improvement and use of the X-ray and the microscope have made it possible to positively diagnose many lesions which would be otherwise questionable, and when any disease is correctly diagnosed, the treatment and prognosis is largely one of personal equation. That is, the resourcefulness of the physician or dentist, combined with the recuperative powers of the patient, are recognized as influential and determining factors.

Initial Efforts.

The initial efforts in Ohio in oral hygiene education were so limited and ineffective, the wonder is that the early enthusiasts did not become discouraged and abandon their activities. These workers frequently met with severe criticism from the members of their own profession, who should have been giving loyal support, but probably this is nothing different from what occurred in other sections and in other States. In this connection it should be understood that constructive criticism has its place and is of positive value, while destructive criticism, or criticism based wholly upon the personality of individuals, is not worthy of serious consideration. Nevertheless, such opposition frequently has a depressing influence, even upon those who may be termed enthusiasts; but unfortunately, such critics are like the poor, they will probably be with us until time is no more.

We have not been fortunate enough to have anything like the Forsyth Dental Infirmary in Boston, or the proposed Rochester Dental Dispensary, but we fully appreciate the humanitarian service these institutions will render in their immediate localities. And what is more, we are confident that their educational influence will extend to all parts of the world and stimulate others in providing similar institutions. The generosity of their donors is highly commendable, especially so since they have blazed new paths in a dense wilderness of oral diseases, and their closing days should be the happier for having provided such real and necessary humanitarian service for the child life of the present and the future generations of their respective cities.

Co-Operating Agencies.

The most active co-operating agencies in this educational movement are as follows:

Ohio Dental Societies.

The Ohio Dental Society, with her twenty-nine components, and the Northern Ohio Dental Association. All of these dental organizations have Oral Hygiene Committees, which are doing considerable effective work. For the past seven or eight years the Ohio State Dental Society has made liberal appropriations for the work of its Oral Hygiene Committee. Such appropriations have ranged from three to five hundred dollars annually, but more often the latter amount.

Ohio State Medical Association.

The Ohio State Medical Association, with approximately 4,500 members, has within the past two or three years shown a marked interest in this work. During this period they have had dentists as contributors to their State Society programs, and have had as well numerous dental contributors before components and district societies. In some

instances the medical and dental societies have held joint meetings, and papers on dental subjects and dental news items have been liberally published in their journal. At the last meeting of this association, President Upham recommended that provision be made for members of the allied professions becoming associate members, and specifically mentioned the dental profession. In order to stimulate a closer relation with such allied professions, he suggested associate membership, including their Journal, at the approximate cost of publishing the Journal.

Ohio State Board of Health.

For the past two years the Ohio State Board of Health has been conducting a public health educational campaign, having for its aim a better informed citizenship in matters relating to health and disease. The responsibility of the individual and of the community in connection with preventable disease is especially emphasized. This Board takes the position that any reduction in the present morbidity rate will be dependent upon an increased knowledge on all questions having any relation to either individual or community health. The reluctance of the public in seeking such information is recognized, and for that reason we are taking it to them, as it were, and placing it in as attractive and forceful way as seems possible and practicable.

"The care of *"public health* has become the *first duty* of the State of Ohio" is our slogan, and every known means is employed to educate the public in this direction. The exhibit consists of standards, models, electrical and mechanical devices, etc. There are three standards on tuberculosis, two on occupational diseases, one on dental hygiene, one on communicable diseases, one on prevention of blindness, and one on infant mortality. On each standard is displayed charts, aphorisms, pictures and statistics relating to the subject. Some of the aphorisms in the dental standard are as follows:

"Particles of food left between the teeth ferment and cause tooth decay."

It is more important to brush your teeth after each meal than to wash your face on rising."

"Prompt attention to decayed teeth prevents suffering and saves money."

"Do you visit a dentist twice a year, or do you wait until your teeth drive you to him?"

The exhibit is shown annually at the State Fair and at as many County Fairs as it is possible to visit. Then it is sent to such county seats and other small cities as request it and make the necessary arrangements; that is, some local organization becomes interested and secures

a place for exhibit room and a meeting hall. The exhibit remains in a location for one week and is open at all times for inspection. A representative of the Board's Staff and a traveling nurse are in charge and prepared to furnish general information regarding the work. In addition to the exhibit, a stereopticon lecture, usually by a member of the Board's staff, on some phase of public health work, is presented as the evening program. This is followed by motion picture films directly related to the subject under discussion. For instance, following a lecture on Dental Hygiene, the "Oral Health" or the "Toothache" film is used. The local press is very generous in giving publicity to this work. The most of the press copy is furnished directly from the Board, and in this way it is possible to secure publicity which is in keeping with the general educational plan.

Education of Teachers in Mouth Hygiene.

In 1913 the General Assembly passed an Act empowering the Governor to appoint a commission to make a thorough survey of the school system of the State of Ohio, with a view of making such changes as were necessary in order to best meet present-day requirements. When this report was completed, a Special Session of the General Assembly was called and a new school code was enacted. In some particulars changes are only gradually put into operation, but in 1921 every teacher must have had not less than one year of normal training in a recognized school for training of teachers.

There are eighty-eight counties in the State and there is already, or soon will be, one county training school in each, with a maximum of three in some of the more populous ones. A standard course of instruction is given in these training schools, and, recognizing the advantage of giving these teachers a thorough course in hygiene, the superintendent of public instruction, with the co-operation of members of the medical and dental professions actively interested in the question, has made provision to have physicians and dentists give a course of standard lectures in the county training schools representing all the phases of hygiene as follows:

The care of the mouth and teeth.
Personal hygiene.
The elementals of first aid.
The hygienic relations of the eyes, ears, nose and throat.
Community hygiene.
The place of play and recreation in a program of hygiene.
Occupational diseases and industrial hygiene.
The backward and feeble-minded child in our public schools.

These lectures have been carefully prepared for this particular course by persons well equipped to present the subjects assigned, and have been reviewed and criticised by members of a committee selected for that purpose, and later by the Superintendent of Public Instruction, and the writer, as a member of the State Board of Health, as advisory members of the committee. This point has been reached, and the lectures are then to be published in book form by the Superintendent of Public Instruction and thereafter will be under the control of his department.

A specified time will be arranged for this course and physicians and dentists, selected by officials of their respective organizations, are to give these lectures so that they may be able to supply any additional information that may be necessary because of questions which may be asked by these prospective teachers. This course has been established because of the belief that teachers wield a positive influence over their pupils, and any special preparation will be of inestimable value to the pupil, since the health of the child is, or at least should be, the one thing for first consideration in the home or in the school.

The Superintendent of Public Instruction, Hon. Frank W. Miller, is thoroughly impressed with the importance of this special instruction and is anxious to put this course in operation at the earliest possible date. Only recently he stated to me, and I am quoting this with his permission: "Personally, I would give one thousand dollars if some form of physical supervision, or a course of instruction such as we have under consideration, had been a part of the school course which I was a pupil in school." Prof. Miller is quite deaf in one ear and has been told by a specialist that this is the result of adenoids. He is confident that this would have been avoided had arrangements, such as we now have under consideration, been in effect when he was in school; and, as the ranking official in the educational system of the State, he is desirous of conserving the health of the school child.

National Mouth Hygiene Association.

The National Mouth Hygiene Association, with headquarters in Cleveland, has conducted intensified educational and financial campaigns in Cleveland, Dayton and Canton. In Cleveland they raised $30,000 for dental clinics. In Canton, the Board of Education appropriated $2,500 for dental clinics, and in Dayton, $500 was similarly appropriated. The general interest and the press publicity received in these campaigns have been important factors in this educational work and, in my opinion, this represents a greater value than the money raised or appropriated.

National Research Institute.

While the Research Institute of the National Dental Association is national in its scope, yet the fact that it has its headquarters in Cleveland and that Ohio dentists have been liberal contributors to their fund, as well as the fact that some of Ohio's philanthropic citizens are interested in its success, prompts me to refer to this as an influential agency in this connection.

Ohio State University.

Commencing last year, the Trustees of the Ohio State University provided for a special lectureship on Oral Hygiene in the College of Medicine. The influence prompting my acceptance of this affiliation was the opportunity to render some service to these medical graduates in a subject which, unfortunately, has been generally neglected. Provision was made for a course of five lectures to the senior class, and the attention they have given indicates a keen interest in the subject.

The Physical Director at the Ohio State University has, in his reports at different times, called attention to the prevalence of dental defects. Such reports are usually given considerable publicity and in that way serve as an educational medium.

Ohio State Institutions.

Ohio has twenty-one State Institutions, in which there are approximately 22,000 State wards, under the control of an Administration Board of four members. In some of these there is an institution dentist, and in others, local dentists render a limited service. A recent conference with the president of this board gives assurance that more dental attention will be given these wards at an early date. This is the result of public dental education, and at the same time has an educational influence and thus becomes a co-operating agency; but at times our efforts to better conditions in these institutions have been rather discouraging.

Dental Clinics.

The establishing of school, municipal and hospital dental clinics and services, as well as the giving of dental lectures and talks before various organizations, have been influential factors in this educational campaign. In order to present an idea as to the establishing and the operating of some of these clinics, a brief synopsis of conditions in a few of the larger cities in the State is herewith incorporated, but it should be understood that there are a number of smaller ones doing very creditable work in this connection.

Cincinnati has one two-chair clinic and three one-chair clinics, under control of the Board of Health, working in conjunction with the Oral Hygiene Committee of their city dental society. Seven one-half-

time (3½ hours per day) dental operators are employed at $50 per month, one full-time supervising nurse at $60 per month, and three full-time assistant dental nurses at $32 per month. The city appropriates $4,000 per year for this work, and the balance for salaries, equipment and materials is raised by public subscription. Their equipment has cost about $400 per chair.

The House of Refuge and the Municipal Tuberculosis Hospital are furnished with a one-chair equipment and a one-half-time operator for each institution, at an expense of $1,200.

At the Cincinnati General Hospital, two complete Forsyth unit equipments, together with instruments, have been installed as a donation from an interested citizen. They have a dental interne, on the same basis as the medical internes, and six junior members on the staff, as assistants, each giving one-half day per week.

Cleveland has five dental clinics in the public schools, under the direction of the Cleveland Auxiliary of the National Mouth Hygiene Association, in conjunction with the Department of the Medical Inspection and Physical Education. Parochial schools are served through a separate clinic. A dentist is chief anesthetist in one of Cleveland's largest hospitals.

In Columbus, for the past four years, members of the local dental society have rendered voluntary services in connection with clinics under the auspices of the Diet Kitchen Association and the Associated Charities. The equipment and materials have largely been donated. Provision has recently been made whereby indigent school children recommended by the Medical Inspector of Schools, or the school nurses under his supervision, will receive necessary dental service in the clinic of the College of Dentistry, Ohio State University. The Board of Education is favorable to establishing school dental clinics, but financial limitations have not permitted of this up to this time, and this arrangement is intended to take care of the situation temporarily. Also, the children at the local orphanage receive dental service through this clinic.

Two dentists are connected with local hospitals, one as nitrous oxid-oxygen anesthetist and the other as consulting dentist and a member of a hospital medical staff.

Toledo has one school clinic under the combined auspices of the Board of Health, Board of Education and Toledo Dental Society. Through voluntary contributions of the members of the Dental Society, a part-time dentist is employed. The Board of Education contemplates taking over this work at some early date.

In Dayton a public school clinic has been established and $500 appropriated for its maintenance.

The Canton Board of Education recently appropriated $2,500 and a school clinic is to be opened at the beginning of the school year, with two part-time operators and a full-time dental nurse.

The Public Press.

Last, but not the least influential, is the Press, which being a positive factor in moulding and stimulating public opinion is entitled to be classed as one of the agencies coming within the scope of this subject. During the past few years there has been an appreciable change in the attitude of the Press toward the activities of the dental profession, and many newspapers are now giving dignified publicity to dental matters, editorial discussions not being infrequent.

When unfavorable and unfortunate publicity has occurred, the reporter is not always entirely responsible. This frequently is the result of the attitude of some members of the profession, whose discourtesies at times might prompt the writing of an unfavorable story, when under different circumstances the reverse would have appeared. The newspaper man is usually above the average in intelligence and generally prefers "boosting" rather than "knocking"; but it should not be overlooked that he is a member of the human family and is at least entitled to fair and considerate treatment. Otherwise, he may show human traits, and it should always be remembered that he has entrée to the reading public.

Municipal Dental Clinics

By Matthew Carney, D.M.D.
Supervising Dentist, Department of Health, New York City, Visiting Dental Surgeon, Bellevue Hospital, New York City.

With a constantly increasing number of ailments directly traceable to defective teeth, the actual need for free dental clinics for school children is not only conceded by leaders in the medical profession but is fast becoming realized by the municipal health and educational authorities and the public in general. Even the tax-payer upon whom the burden falls, in the case of free dental clinics that are supported by the municipality is beginning to realize that preventive medicine and preventive dentistry are not an expense, but the essence of true economy. When the extraction and straightening of teeth in childhood, the prompt attention to incipient caries and the early training of children to practice cleanliness of the mouth and teeth can be shown to overcome backwardness in school and to prevent not only a score of diseases, but death itself, there can be no question as to the economic value of the free dental clinic, to say nothing of its humanitarian phases. I shall not attempt to discuss vital statistics nor to make economic comparisons, for I am sure that anyone of intelligence will readily concede that it is better for any community to raise healthy children with clear brains, hygienic habits and good teeth, than to burden the department of charity in later years, to fill hospitals and poor farms and have a fleet of human derelicts, physically wrecked, to represent the rising generation of our poor.

If there exists any question as to the actual value of institutions founded to arrest dental decay and give good masticating apparatus to the children, one needs but to look at the results accomplished by our dental clinics in New York City.

Results in Dental Clinics in New York.

In January, 1913, the Department of Health opened six dental clinics for school children and one for the care of children and adults suffering from tuberculosis, who were candidates for the preventorian and tubercular hospitals. The first six are associated with the Bureau of Child Hygiene and the last one with the Bureau

of Communicable Diseases. These clinics are located in the congested sections of the city and are maintained in connection with those that provide medical and surgical treatment for diseases of the eye, ear, nose and throat.

The following extract from the Weekly Bulletin of the Department of Health of the City of New York, dated March 8, 1913, is self explanatory:

"The budget schedule for 1913 made provision for the employment of one supervising dentist and nine staff dentists. These dentists are now on duty, and six clinics have been established as follows: Two in the Borough of Manhattan, three in the Borough of Brooklyn, and one in the Borough of the Bronx.

"Since the department inaugurated the physical examination of children in the public schools, it has been increasingly evident that dental defects are not only more prevalent than other physical defects, but that the facilities for free dental treatment are absolutely inadequate to provide any relief for the situation. Approximately sixty per cent. of all children examined have been found to have decayed teeth. In many instances the defects of the teeth have been so extensive and far advanced that corrective treatment, even if it could be obtained, would be of little value.

"The present registration in the public schools is approximately 700,000. There are, therefore, at a conservative estimate, 520,000 public school children in this city in urgent need of dental treatment. The majority of these children are from families who are unable to pay for the needed care. The Division of Child Hygiene has made exhaustive efforts to obtain dental treatment for these children, but, owing to the lack of facilities, only a small percentage have received attention. In order, however, to carry out its policy of preventive hygiene, the school nurses of the Department of Health have for the past four years given instruction in dental hygiene to all children with dental defects and have successfully maintained a system of so-called "tooth-brush drills," with instruction in the care of the mouths and teeth for the younger children in the public schools."

In January, 1913, nine dentists were assigned to care for the dental defects of over 600,000 school children. They went at the problem with a will and up to July 1, 1915, after two years' work, succeeded in accomplishing the following amount of work:

Number of children treated	20,879
Number discharged	178,250
Number normal	141,000
Number cured	12,787
Number dropped	5,027
Number of treatments	144,601
Number of fillings	57,567

Number temporary	48,689
Number of extractions	38,315
Number deciduous	33,208
Number permanent	5,107
Number of cleanings	19,871
Other operations	1,500 app.

The school population to-day is over 900,000 and when the fall term opens it is calculated that there will be over 1,000,000 children enrolled in the public schools of Greater New York City.

Percentage of Dental Defectures.

The previous dental examinations were performed by the medical inspectors and were purely superficial. Estimates derived from more careful examination of the mouths of school children, performed by dentists show a much larger percentage of decay and from personal observations, in our schools and clinics, I would say that eighty per cent. was more nearly correct than sixty per cent.

The British Physical Deterioration Committee compiled the following table of the percentage of children in various sections of Europe, suffering from dental caries:

English and Scotch	86.00
Berlin children	94.70
Halifax children	95.00
Children of Northern Germany	95.00
Cambridge Dental Clinic	96.50
Kettering children	98.60
Hamburg children	98.40
Baden children	98.75

Considering the increased enrollment I dare say that there will be at least 800,000 cases of dental caries for the municipal clinics to combat in the fall.

The number of clinics is so small that we are unable to begin to cope with this tremendous problem; we have simply blazed a trail through this jungle of decay and confidently hope and expect that in the near future money will be forthcoming whereby the number of clinics may be substantially increased.

Demonstrated Value of Treatment.

The work that has been done has demonstrated its value in many ways. It has awakened the laity to the fact that the teeth of children are important and have a decided influence upon the physical and mental development of the children. It has reduced the number of absentees in the schools, thereby allowing the child to de-

vote his time to learning and making his promotion more certain, and by doing this has reduced the cost of education, for the money required for the re-education of the children left behind each year is a very large amount. The following table, taken from an article written by J. J. Cronin, M.D., Assistant Director of the Bureau of Child Hygiene, and read before the Dental Society of the State of New York, in 1914, will illustrate my point:

	Registration	
Class	P. S. 122	P. S. 63
1A	314	121
1B	136	144
2A	181	133
2B	187	175
	818	573

Note—In P. S. 122, twenty per cent. of the absences occur in those who received dental treatment, as compared with forty-five per cent. absences among those who did not receive dental treatment.

	P. S. 122		P. S. 63	
Attended private dentist	41	403	27	134
Attended dental clinic	362		107	
Not receiving dental treatment	415		439	
Absentees receiving dental care	156—39%		89	
Absentees not receiving dental care	380—94%		243	

The cost of educating a child in New York City is twenty cents a day. The cost for the school year from the second Monday in September to the last of June, or for 200 school days is $40.00. The cost for dental treatment, including the equipment, is $4.10, to put the mouth of the child in good condition and make learning easier, and health better, and life a pleasure.

Economic Phase of Oral Hygiene.

Dr. Cronin in the above mentioned article has very comprehensively written about the economic phase of oral hygiene, and I can do no better than to quote this paragraph:

"Considering that eight years is the limit that most children spend in school to qualify for provident citizenship, and that anything that interferes with this time is a loss to the individual, the probable cost to the city in caring for irresponsibles is appalling. Children with bad teeth and bad mouth hygiene are the ones who most surely contract contagious diseases —scarlet fever, measles, diphtheria—and it is interesting to consider the numbers who would have escaped if their oral conditions had been sound and healthy. The loss in future morale is even more.

"Medical men need no proof of these conditions. We know in our own practice that certain children do not contract contagious diseases, because they are physically normal. If the proper repair of teeth will prevent contagion what a saving it would be to assure adequate dental service! Children in the early stages of tuberculosis are not admitted to the preventories until the teeth and mouth are in good, wholesome condition. 'There is no single factor that so impoverishes a community as disease, and there is no single portal that so greatly predisposes to disease as bad teeth and bad oral hygiene.' The conclusion, therefore, seems inevitable that, if a community seriously wishes to rid itself of the stigma of a high incidence of contagious cases, it must provide for a proper oral hygiene education of children in the homes and in the schools. Tooth-brush drills and hygiene leagues are valuable factors in schools. Mouth hygiene must be considered as a routine procedure, and children constantly advised to brush their teeth."

Considering these facts and numerous others that might be mentioned it is conclusive that the establishment of free dental clinics for needy poor children is not only an example of true civic helpfulness but a stroke in actual civic economy. The old adage of "an ounce of prevention being worth a pound of cure" must have been written by a dentist.

Mr. Edward F. Brown, Superintendent of the Bureau of Welfare of School Children, in an article which he wrote on the dental clinics of New York City, said that the work performed by the Dental Clinics of the Department of Health was of the best. These clinics have done much good, they have rendered a vast amount of service and demonstrated their practicality and usefulness.

Small Widely Separated Clinics Advisable.

The single unit idea that has been adopted in New York is the solution of the dental clinic problem. It is far more serviceable and more efficient than having one central clinic. These smaller clinics situated as they are in the hearts of congested school districts, are easier of access and better patronized than if the dental efforts of the city were being carried on in one institution remote from the congested areas.

Another important point to establish is that the care of the teeth is a question of health and not a problem of education, and for that reason the work should be confined to the Department of Health and be performed in the health centers or clinics, and not associated with the Department of Education and performed in the educational centers, or schools. The Department of Education can co-operate and aid the work materially and one school teacher who is vitally interested in the welfare of the children and the propagation of oral hygiene can do incalculable good. It is a fact that a school teacher can get close to the chil-

dren and enlist their co-operation and arouse their interest far better than a half dozen nurses or a dozen doctors.

Importance of Competent Service.

The nature of the work performed in municipal clinics should be both reconstructive and preventative. The teeth should be properly filled with a good material and a conscientious effort made to perform lasting work. Many of these children will never have an opportunity to visit a dentist again until they are old enough to earn a living and pay for their work, and if the dentistry performed for them in childhood has been lasting and they have been impressed by it the profession will reap its pecuniary reward upon the maturity of the patient. On the other hand, if the work is carelessly performed, the tooth is troublesome, and eventually lost, or the fillings keep coming out, a wrong impression is created and the patient becomes discouraged and considers dentistry useless and an extravagance. The preventive side of dentistry should constantly be impressed upon the fertile mind of the young patients. They should receive talks on brushing the teeth, the advantages of a clean mouth, etc., every time they visit the clinic and these instructions should be amplified and enforced in the class room.

The supervision of the work in the municipal clinics is an important factor. The various lines of treatment to be followed in the correction of the varied conditions falls entirely upon the supervisor. He must see to it that the work is uniform throughout the city and that each operator is both competent and conscientious. It is more difficult than one would expect, to have a number of operators follow along certain lines, each using his own professional judgment, and produce results that are uniformally satisfactory. Judgment can only be passed upon the general amount of the work when examinations are made at a later period, or upon the revisit of the case, for it is an easy matter for any operator to follow the code of instructions when his supervisor is watching him work, and to serve in the absence of his superior.

We have been fortunate in New York in procuring conscientious workmen and in having the assistance of an Advisory Council, composed of the leaders in the dental profession in our city. This Council has done much to aid the work and to put it upon the high plane it now is on.

We have merely laid the foundation for this work and the results lead us to believe that we have started right. I have brought out a few important facts in connection with the establishment of municipal clinics and have shown some of the results that are derived therefrom. The number and force must grow until it is capable of handling at least the

number of new registrations in the schools each year, and until it has reached that high water mark it will not render to the community the service that a municipal protective department should.

These clinics are an insurance against the spread of the diseases of childhood, and aid materially in the making of better, healthier and more useful citizens; and I have presented this outline of the work of the municipal dental clinics of New York City in the hope that it may direct the attention of the health authorities in other cities to the vital importance of this work and lead to the establishment of municipal dental clinics in every city in this country.

The Educational Value of Oral Hygiene in the Army.

By Edwin Payne Tignor, M.D., D.D.S., First Lieutenant Dental Surgeon, U. S. A.

The causes, which led to the establishment of a corps of dental surgeons in the Army, were no doubt purely humanitarian and had as their object the relief of suffering and improvement of the health of the troops, through the correction of pathological conditions of the mouth and teeth, such potent factors for evil in the human economy. It is hardly probable that the gentlemen, who strove so earnestly to have this corps established, realized the scope of the work they had started or that good would result to others than the immediate personnel of the Army.

It is the purpose of this paper to bring to your attention some of the facts relative to the influence that is being exerted on society by the work of the Army Dental Corps.

The primary purpose for which the corps was organized has been only partially accomplished, due to the peculiar conditions of military service. In the practice of dentistry in civil life it is generally supposed by the laity that one dental surgeon can properly care for all the inhabitants of a town of one thousand and those who are practicing in towns of this size certainly find an occasional hour for recreation. On the other hand, men of wide reputation have testified that about three hundred patients are all that one dentist can care for.

Why, then, is the dentist in the small town not overworked? The reasons are many: First, good dentistry takes time and is expensive; so much so that many of the poorer people cannot or think they cannot afford it. Second, few children receive treatment and the old require little. This leaves mainly the young adults of moderate means and many of these are kept away through fear or ignorance. So our town of a thousand is reduced to a few hundred who think they require treatment, a small percentage of which will seek it. Because the dentist in the small town is not kept busy, the impression has gone abroad that a dentist can care for a thousand individuals and it is not surprising that Congress thought it was making ample provision for the Army when it provided for a corps of one to one thousand of the enlisted strength.

Conditions of Practice in the Army.

Let us now turn from the picture of a town of a thousand to an Army post in which are quartered a thousand enlisted men. Here conditions are reversed. Instead of elimination we must add to one thousand young adults the officers, their families, the families of the married soldiers and the civilians employed on the post in various capacities, approximately five hundred individuals, who under existing regulations are entitled to free medical and dental treatment.

Examination of many thousand recruits has revealed the fact that about 90 per cent. enter the Army in need of dental treatment, a very large percentage of them having never visited a dentist and usually presenting very dirty mouths containing carious roots with apical infection, one or more teeth with dead pulps or chronic pulpitis, salivary deposits and gingivitis, besides many teeth affected with simple caries.

We have then among one thousand soldiers an average of nine hundred in need of extensive treatment, and as the treatment is both free and obligatory, none are kept away through fear, ignorance or lack of means. Among the additional members of an Army garrison some may be kept away through fear of pain but, as their treatment is free, the question of cost does not enter so that it is safe to state that in a post in which a thousand soldiers are stationed there will be at least twelve hundred patients. As most of the soldiers are replaced after one short enlistment by new recruits, I believe that you will agree with me that it is physically impossible for one dental surgeon to *make* and *keep* these men orally healthy, without which no fair conclusion can be reached as to the influence of oral treatment on the health of the Army.

The picture that has just been held up for your inspection is, however, inadequate and does not fully depict the conditions. It is true that Congress has provided for a corps of one dental surgeon to one thousand soldiers but it is not true that we have a corps of that size. In fact, there are now but twenty-eight first lieutenants and forty acting dental surgeons, a total of sixty-eight, while the strength of the Army is over one hundred thousand, so that the actual proportion at the present time is approximately one to fifteen hundred, besides families and civilians entitled to treatment.

This, however, is an improvement on conditions as they existed until very recently. For ten years the strength of the dental corps was only thirty-one, so distributed that there was only one for each of the nine military departments in the United States in existence at that time, the others being at West Point, the general hospitals, recruit depots and in the Philippines. During a part of this period, from June, 1907, to June, 1909, the writer was stationed in the Department of the East and at-

tempted the treatment of fifteen thousand soldiers, distributed among thirty-five posts extending from Maine to Virginia. You will see that it has been impossible except in rare instances for the dental surgeon to do himself, his patients or his profession justice; to do as was intended that he should, improve the health of the Army.

However, he has accomplished something: He has alleviated the suffering of thousands, improved the health of many and, better perhaps certainly farther reaching in its influence, has assisted very materially in educating thousands as to the importance of dental health, for he has been able to reach into the remote corners, into places and by means closed to civilian practice and spread the doctrine that oral health means bodily health.

Influence of Army Dentist's Work.

To show more clearly how this is being done, I will begin with the recruit and follow him through his enlistment period and back to his home.

While the men composing our Army are drawn from all classes of society and all parts of the country, by far the greater number are from the poorer classes, many coming from the tenement districts of our large cities or from isolated country districts; many others from the middle classes of the smaller towns and country places.

Many men from the two classes mentioned enter the Army with pathological mouths. They have had little if any treatment and know little of the tooth brush and nothing of the dangers of a neglected mouth. They have never thought of their teeth unless they gave them pain, and then their one idea has been to get rid of either the pain or the tooth. They have never been taught that dirty and diseased mouths are sources of danger to their general health.

These men upon their enlistment are sent to one of the recruit depots. Upon their arrival they are given a thorough physical examination, which includes an examination of the mouth. They are given a bath and haircut, new underwear, uniforms and toilet articles, including a tooth brush. They then receive prophylactic treatment against smallpox and typhoid fever and are sent to the dental surgeon for further examination and instruction. The dental surgeon gives them a thorough mouth examination, removes deposits from the teeth, extracts all roots of teeth that cannot be saved, treats cases that might give pain before they reach their stations, gives them instruction in the use of the tooth brush and tries to impress upon them the importance of mouth hygiene.

Recruits remain at the depot two months, during which time they are required to use the tooth brush daily and a non-commissioned officer

sees that this regulation is obeyed. (If you are skeptical as to results, go to a recruit depot and examine the mouths of the men that are received in one day, then return two months later and examine the same mouths when the men are ready to go out and join their regiments.) The men are also advised to go to a dental surgeon as soon as they reach their stations for the treatment of cases that could not receive attention while at the depot. They are told, "If there is no dentist at the post, go to one in the nearest town."

That the men do profit by the instruction they receive is evidenced by the fact that the dental surgeon is never idle. Further, it is only in very rare instances that it becomes necessary to *order* a man to submit to treatment. Also having once had treatment, he almost invariably returns upon the slightest indication of trouble. In other words, by the time our recruit has served his three years as a soldier and is ready to go back to his home and citizenship, he fully appreciates the importance of dental health and will go out among his fellows as an advocate of oral hygiene.

When we consider that thirty thousand soldiers go back to their homes each year, it becomes necessary not only that they learn to appreciate the value of oral hygiene and oral health but to respect the profession that teaches them the one and helps them to obtain the other. They should carry with them a high ideal of the dental profession and so be able to discriminate between the professional man and the quack; to shun the so-called dental parlors and avoid those who advertise.

To accomplish this end it is necessary that the personnel of the dental corps be only of the highest type of the skilled professional man and it is to the interest of the dental profession that they give us of their best. Our examiners have been criticised at times for making the examinations too difficult. My answer is that they cannot be too *thorough.* The Army does not want and the dental profession does not want men in the corps, who are failures and who are attracted to the Army simply because it offers them a position in which a definite income is assured.

We want the best in the dental profession and we want a sufficient number to make a healthy mouth for every individual of our country's defenders. When this is done the educational value of the Army Dental Corps, speaking through thirty thousand healthy mouths each year, will be inestimable.

Next Steps in the Development of Oral Hygiene Among School Children.

By Edward F. Brown, Superintendent Bureau of Welfare of School Children N. Y. Association for Improving the Condition of the Poor.

Seven Oral Hygiene Manifestations.

Those who have seen active service in the attempt to improve the deplorable condition of the teeth of school children must have been impressed with at least seven things.

1. There are probably more teeth in need of professional treatment than there are practitioners to treat them.

2. Ignorance of the evil effects of dental diseases is a stumbling block in the path of progress.

3. Municipal officials charged with the appropriation of money for public health often fail to make adequate provision for dental care.

4. The study of physiology and hygiene in many public schools has laid greatest stress on the dangers of alcohol and tobacco while the care of the teeth has, with other lessons of practical personal hygiene, been subordinated.

5. Oral hygiene when properly presented to children is a subject to which they respond with great enthusiasm.

6. Large numbers of children too poor to pay for private treatment have no place to go to arrest the dangers of decaying teeth.

7. There appears to be need for a rational development of two constructive programs:

(a) A program of prevention.
(b) A program of cure.

The care of the teeth of school children is essentially a matter of public health. Above all there must be a well organized effort in which not merely the dentist but the doctor, the educator, the sociologist and others interested in the general welfare of the child should take part.

The Prenatal Groundwork for Sound Teeth.

With our increasing knowledge of the functions and reactions of the human body to external influences, we have come to realize that the prospective mother must not, either through ignorance or the lack of opportunity to gain knowledge, impair the

health of her unborn child by failing to provide it with the essential elements needed for healthy growth. Prospective mothers must, therefore, be informed of the relationship between diet, their teeth and the influence these have on the coming child. The popular fallacy that for each child born the mother must lose one tooth must be destroyed. Immigrant mothers in congested quarters of our cities have come to look upon aching teeth during pregnancy as an evil which must be borne with and for which there is no hope of relief.

Prenatal Registration Recommended.

But how to reach the prospective mother? Here I would suggest that there be inaugurated, not alone for this but for other purposes, a compulsory system of prenatal registration. That is, physicians should be required to report to the Health Department all cases of pregnancy coming to their attention. As soon as such a registration is made, it should be the function of the health authorities to send immediately to each woman who is *enceinte* a notice calling her attention to the dangers which lurk in doing anything other than that which is prescribed in the official notice. Of course, mouth hygiene is but one part of the great work of infant conservation which should commence actually before the child is born.

What Some Mothers Need to Know.

Such specific advice, given under the authority of the public officials, should in a simple manner, and in different languages, cover:

1. The need for repairing defective teeth.
2. How to prevent dental decay.
3. How to clean the teeth.
4. What to clean teeth with.
5. What foods to eat and the effect certain foods have on sound teeth.
6. The special diet with an abundance of mineral matter during pregnancy.
7. What evil effects flow from neglected teeth.
8. The care of the mouth of the infant.
9. Teething children and their care.
10. The first teeth of the child.
11. The care of the child's teeth.

These principles need not be taught all at once, but such lessons might be sent to the parent as the need arises. When the registration of pregnancy is made, the first six lessons should be taught; when the birth certificate is registered, it is time to send the eighth lesson; when teething time is at hand, the ninth and tenth lessons; when the child

reaches school, the tenth and eleventh lessons. Then the school should pick up the work where the mother leaves off and continue the teaching until the habit is firmly inplanted.

Prenatal Registration and Infant Hygiene.

The author does not lose sight of the fact that dental care is but one small phase of the tremendous task of the hygiene of pregnancy and child care.

The value of compulsory prenatal registration is that it gives to the child hygiene authorities of the health department a clew as to where their educational work will be of greatest value. It is to be expected that such registration would have a tendency to reduce the death rate of infants, through seeking to control the factors which, neglected in the prenatal period, may have a fatal effect on the child or its mother after birth.

Public Centers of Dental Treatment.

There should be established in centrally located quarters, preferably in school buildings, dental consultation rooms and dispensaries where the people of the district might obtain reliable information and advice regarding teeth. At such a center printed material could be distributed (possibly in different languages) giving in simple words the principles governing the care of the teeth. Here, again, the dental department should be merely a part of a general school clinic scheme which might include the treatment of non-operative ailments such as refractions, non-contagious eye diseases, ear troubles, skin diseases and dental defects.

In addition to these activities, hours of consultation for advice should be set apart.

Certain objections to any such plan might be anticipated, and so far as they relate to the dental problem, they may also be applied to the other functions.

Certain Objections Anticipated and Explained.

1. Shall these dispensaries be established for the needy alone?

2. Is it fair to tax the whole population for a service rendered to a special class?

3. Is such a procedure subversive of parental responsibility?

4. Does this destroy a portion of the dental profession's legitimate profits?

Ancient and modern civilizations have alike bestowed, in unstinted measure, relief for the helpless. The needy have always been provided

for, even though not infrequently the relief did little to probe and prevent the causes of such dependency.

The State, founded on the principle that its greatness was directly proportional to the physical soundness of its citizenry, took the steps needed to build up the broken down man. To permit this class to languish in its distress is to invite national disaster.

The State Must Conserve Human Life.

Where the subject of the State's compassion and concern has been the child, it has been particularly hazardous to permit its growth to be impaired, for the child conceived in neglect is brought forth in misery as the socially irresponsible man, and as such is a burden and menace to society.

Surely in this era of social advance no argument should be needed to convince us of the social ethics and wisdom of caring for the needy, whether it be to clothe the naked body, give shelter to the shelterless, feed the hungry, or cure disease.

There is hardly an informed person, reared in the ideals of modern social responsibility, who would leave the helpless to their certain fate.

We need to be sure, however, that whatever form this relief takes, it should be calculated to reach the roots of the causes of distress and so far as possible remove these causes.

The Tax Rate and Disease.

If we agree, then, that it is a wise social policy to establish dental and other centers of information and treatment for the necessitous, someone will say, with profoundness and wisdom: "Must I pay for the support of an institution from which I ask and receive no service?"

The answer to that is that under ideal conditions the State's service will be for all its citizens regardless of need—and, what is more, it will not be indelicate to go to such public stations for relief and be pointed out, as frequently happens, as a pauper.

That the more opulent citizen gets no service from such a place, even though he shuns it, is to my view open to some question. What of the spiritual content which flows from the knowledge that the sick are being succored? What of the material satisfaction that this tax rate would be considerably increased to pay for the unproductive units in society which social neglect would produce? Hospitals, almshouses, municipal lodging houses, and not infrequently prisons, would have to be constructed and maintained to care for the misfits and incompetents which might have been made productive, happy and helpful citizens but for this neglect in childhood. These charges must be met from the tax rate.

The precarious condition of the finances of many of our municipalities makes it impractical at this time to urge the development of medical, surgical and dental repair stations to treat the defects of all their citizens. This should be an ideal to which to aspire. The present pressing need is to develop at once a sufficient equipment to care for the needy.

The next objection which we anticipate is that the establishment of dental clinics is subversive of parental responsibility. This I believe to be a fallacy too often given credence. Of all things, people hate anything which savors of relief or charity (in their commonly accepted meanings). They shrink from it as though contact with it were loathsome. It is only when the grim balance sheet reads like an invitation to poverty that these public relief depots are resorted to.

We often fail to recognize in the public clinic dispensary the patient who has fallen under the load of responsibility. Such a person's sense of responsibility is not heightened by neglect, nor is the social responsibility lessened through caring for the less fortunate.

Socializing the Dental Profession.

To the dentist who looks upon his profession merely as a means of profit-making, regardless of all else, we say that he is sadly lacking in professional ideals. We do not begrudge him an adequate payment for the work he does. But disease must be wiped out at all costs, regardless of the incidental inconveniences and sacrifices which will be encountered. Disease is a social menace—an enemy of the State. The doctors and dentists must protect us from distress— not because we have the money to pay therefor—but because it is right that it should be done. The socialization of these professions and the promotion of health, are charges which the State should be glad to liquidate, for health is essential—it is the keystone of life.

Public Education and Prevention.

Man is subject to no disease so widespread as dental disturbances. The dangers to which these expose us are legion. It is doubtful, as was stated before, whether there are enough dentists to go around. It may even be that we shall have to abandon any attempt to correct all defective teeth and concentrate our efforts on a scheme of preventing decay as far as possible in the children, and thus through education seek to uproot the causes.

Above all, we must depend on public education as a means of prevention of dental disease. Our greatest hope lies in this direction. Such education, however, must follow a carefully prepared plan. The kindergarten, through nursery rhymes and actual tooth brush demonstrations, can well adapt itself to the needs of early training in oral hygiene. In

the grade schools systematic instruction could be given as a regular part of the school curriculum. In addition, dental inspection by teachers impresses on the child the fact that clean teeth are as important as a clean face or polished boots. Prizes for clean teeth encourage a friendly rivalry among children for perfection. Let children, instead of writing compositions about horses and dogs, write essays on the care of the teeth and other topics of personal hygiene.

Resume.

Thus, in a word, we may say that the next steps in the development of better health through mouth hygiene lies in education, preventive practice, and an understanding among the dental profession of socialized health as against capitalized disease.

Making the Exposed Tooth Surfaces Slippery.

An Address to General Practitioners in Particular.

By Leander Van Orden, M.D., D.D.S., San Francisco, Calif.

Careful observations of facts, deductions therefrom, and intelligent effort following those deductions have led to most of the advancements in life. The lifting of the kettle's lid by steam, observed and pondered upon, led to the modern means of transportation and manufacture. Observation of the soaring and gliding movements of birds led to the hopeful efforts of men to fly, and to-day we have controlled navigation of the air in heavier-than-air machines.

In our own sphere of activity there has come into use a saying that "clean teeth do not decay." The clean teeth referred to have probably been those with noticeably fine enamel structure, attractive to the eye, not only through their lustre and smoothness, but by the firm, non-receded gum tissues that suround them. The legend, "Clean Teeth Do Not Decay" has been placed upon infirmary walls quite as largely to encourage the patients in their home endeavors to keep the teeth free from food débris as to influence the undergraduate students in efforts to secure literal cleanliness of the teeth for them. This is not intended as a reflection upon our dental colleges. The teachings in professional schools, aside from laboratory subjects, such as biology and chemistry, have very largely reflected the average of general practice. Indeed, it would be much more profitable to dwell upon the great services and steady advancement of our schools than upon their defects, for which we as practitioners are so largely responsible.

Do Clean Teeth Decay?

The teaching that "clean teeth do not decay" has been measurably accepted by dentists, especially since the announcement by Miller, in 1885, of his chemico-parasitic theory of decay. It has long been known that dental enamel is the hardest organic substance; but along with this knowledge there has been a belief that the lustre and hardness of the enamel surface were at their maximum at the time of eruption, although some notice has been taken of green stain and some efforts made toward

its eradication. Unfortunately, this misapprehension respecting the possibilities of bettering the enamel conditions (a misapprehension in which the writer for many years shared), has amounted almost to a superstition and has prevented or checked hopeful efforts in that direction for a long period in the past. Even in the more recent decades, not only the devoted investigations and the conclusions of Miller respecting the causes of dental caries, but the added studies of J. Leon Williams and of Black (as well as an appreciated list of others) have as yet scarcely set in motion the simple, near-at-hand, mechanical processes that can be applied for the partial amelioration, at least, of so serious a scourge as dental caries.

Pickerill,* while laying special stress upon dietetic remedies for dental caries, and taking a broad survey of aspects which lead either to comparative immunity or to great susceptibility to the affliction, makes the following statement:

Pickerill's Views.

"If the enamel surface of 'native' teeth be regarded as 'normal,' then that of civilized and recent teeth must as a general rule be regarded as abnormal, for in the vast majority of cases the two are materially different." He goes on to say: "The collection of skulls previously mentioned as being examined was in a disarranged state, and thus one had no direct reason to know to what race a skull belonged until reference was made to the catalogue afterwards; and it was found that one was soon able to distinguish native from European skulls merely by the appearance of the enamel under the microscope.

"In the teeth of uncivilized races the surface of the enamel is *lustrous, i. e.,* reflects much unbroken light from its surface; the imbrication lines" [which he regards as evidence of checks in the secretive function of the ameloblasts] "are often difficult to make out—on account of the fact that the graphite does not adhere to the enamel as it does in *malacotic* (or soft) teeth, and thus the surface is difficult to stain. . . . .

" . . . . The points that strike one in the examination of the enamel surface of teeth of civilized races are the comparative lack of lustre, the ease with which the surface ridges can be made out with the naked eye, the facility with which they stain by the graphite method. . . . Microscopically, the ridges are seen to be both wider and deeper when examined by reflected light and also in the ordinary way by sections. And it is a most significant fact that the more susceptible the mouth from

*H. P. Pickerill, M.D., "The Prevention of Dental Caries and Oral Sepsis." (London: Balliere, Tindall and Cox, 1912.)

which the teeth are taken, and the more *malacotic* the type of tooth is, the more marked and wider and deeper are the imbrication lines."

Pickerill also refers to developmental fissures or defects in the enamel, some of which are, regrettably, on the mesial and distal surfaces of the teeth, and in a territory one-half the distance between the cervix and the occlusal surface. On page 87 is given a photo-micrograph (Fig. 1) of low power that is almost startling in its significance as being taken from near the cervix of the distal surface of the crown of a molar tooth. The

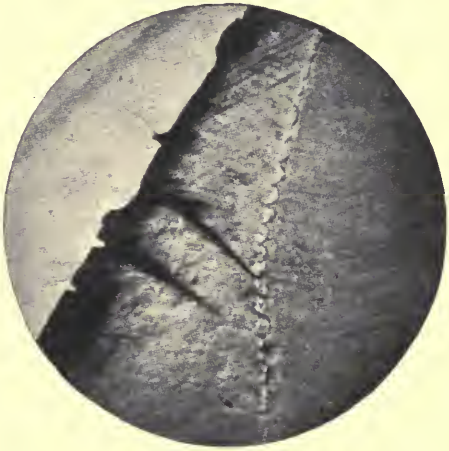

Fig. 1.
Development Fissure in the Enamel near the Cervix of a Malacatic Molar—Low Power. Pickerill.
From Page 87—Prevention of Dental Caries and Oral Sepsis.—H. P. Pickerill, M.D., etc.

parallel, horizontal fissures are so deep and the contiguous surfaces so rough as to suggest that either a calcareous deposit or a carious process must almost inevitably supervene; they hint at the cause of roughness felt by the scaler on many teeth not yet suffering from gum recessions or from calcareous deposits. Pickerill's conclusions are that *"these departures from the normal structure* are potent factors in lessening the resistance of the teeth to caries. They must favor considerably the adhesion of food-stuffs and micro-organisms; they expose a larger and more vulnerable surface to the acid produced; they negative both physiological and prophylactic measures, and the fissures which have been described, since they allow of penetration of silver nitrate and graphite, must permit the penetration of lactic acid if not of carbo-hydrates. In fact, *ceteris paribus,* it may be quite logically inferred that the amount of graphite which an enamel surface retains is a measure of the amount of food-stuff it would tend to retain, and a demonstration of the situations of its

retention. Added to which is the demonstrable fact that teeth so affected are not infrequently likewise the subject of caries."

In the following chapter (9), Pickerill considers the permeability of the enamel surface, the density of the enamel body and the hardness of the enamel surface. He concludes thus: "That the enamel of teeth varies appreciably as to surface structure, hardness, density, permeability and solubility;" and further, "That these variations are measurable and in all cases bear a distinct relationship to the clinical classification of teeth into *sclerotic* (or hard) and *malacotic* (or soft) types—that, in fact, there is demonstrable difference between hard and soft enamel, and that these differences are sufficiently contrasted to justify the terms."

He finally states that it is necessary to promote hygienic, dietetic and prophylactic conditions in order to obtain enamel of the highest resistance to caries. His conclusions are the result of laboratory experiments, but they are in the main largely supported by clinical experience; and he makes a plea for a more respectful appreciation of clinical findings when the average of a large number of such observations is all in one direction (page 116).

Marginal Gingivitis.

What has gone before relates to dental caries, but may in large measure be applied to the subject of marginal gingivitis, with its successive stages leading to acute and chronic suppurative pericementitis, somewhat more vaguely classified under the term pyorrhea alveolaris. Fortunately, this year of 1915 has a special element for dentistry. The new volume on *"Special Dental Pathology,"* by Prof. Black,* will long mark for us this period of celebration of a great world achievement—the completion of the Panama Canal. That such exhaustive works as those of Pickerill and Black are at our daily command—not forgetting the many other able students and contributors—should be among the chief subjects for congratulation and felicitation by the attendants upon and supporters of the Panama Pacific International Dental Congress.

Prof. Black's Views on the Gingivæ.

It must have occurred to many that a simple marginal gingivitis is the essential preliminary to the later suppurative stages; but we are indebted to Prof. Black and his son for clear and definitive writings as they have appeared in dental journals in recent years. Prof. Black in his new work states: "The gingivæ stand in the position of protection to the deeper investments of the teeth and their attachments in their bony alveoli. These attachments and the preservation of them are of first importance to the functions of the teeth. It is

*G. V. Black, M.D., D.D.S., Sc.D., LL.D., "Special Dental Pathology."

our duty as dentists to look as closely after the health of these tissues as that of the hard tooth tissues, and to conserve and protect them from injury to the fullest extent possible." Again he says: "There is no more promising field for the study and practice of prevention than in the group of conditions which are the exciting causes of the inflammations of the gingivæ. Most dentists seem not to have recognized many of these causes at all; or if they have not failed to recognize them, they have failed to appreciate the direct relationship between the apparently trivial gingivitis and the more serious lesion of the peridental membrane which results." "It will," he thinks, "be realized that the treatment of the beginnings of disease of the gingivæ belongs to the general practice of dentistry. The first element of this is the watchfulness of the practitioner for the beginning injury. In the very nature of things, this must be discovered by the general practitioner and not left to specialists, who, as a rule, do not see these cases early enough to apply preventive treatment. It is the general practitioner who must discover salivary and serumal calculus and remove the same, and train and control patients in the care of their mouths so that these deposits my be prevented. If one is practicing dentistry at all, he should be acute enough to see these things and skillful enough to prevent or correct them. Our greatest hope for the future is in the application of preventive treatment by all dentists, rather than by the use of palliative treatment by specialists. Up to the present time but few dentists have applied treatment to prevent the formation of pus pockets, the large majority having deferred treatment until after the pockets have been formed. As a first effort in practice, this must be exchanged for a systematic scheme of observation for the detection of the conditions which act in the causation of pus pockets, and the correction of these before they have done serious harm. We have become so inured to a certain phase of thought toward the soft tissue investments of the teeth—a phase of neglect of their appeals for help—that a change to greater care is more of a task than most persons would suppose." And again he says: "Somehow the treatment of dental caries by fillings and other operations has become the principal service of the dentist to such an extent that the soft tissues are neglected until it becomes apparent that severe disease has developed, and that there is imminent danger that the teeth will be lost."

That is but a gentle arraignment of our undoubted remissness, to which the writer and nearly all others must plead quilty in some degree or other. But Prof. Black has preferred to use his valuable space in indicating the path which may be taken toward a better standard of practice. The plan that he outlines as being effective only as it is undertaken seriously and systematically is as follows:

"(1) The careful examination of the gingivæ as a part of the routine examination of each mouth; (2) a record of the areas of inflammation observed; (3) a study of the cause of each such area; (4) the treatment necessary to remove the cause; (5) the careful training of the patient in the care of the mouth; (6) subsequent examinations."

It would be of interest to review much of the wise instruction of Prof. Black, such as, care to avoid injuries to soft tissues, and especially to the septal tissues in all operations; the restoration and maintenance of contact points, and the control of the occlusion. But the intent of this writing is to present one phase, mainly, of the means of prevention and cure—the making of teeth *"slippery."* As the good effects of efforts to this end have been observed year after year, the more has it seemed incumbent that appeals should be made to general practitioners until a very much larger percentage should have become interested and engaged in efforts which pay such a large return in self-respect for the practitioner, increased health for the patient, and cosmetic qualities in which many may share.

Dr. D. D. Smith's Work.

As in orthodontia practice, the most profitable results are obtained when patients are young; yet remarkable results are to be anticipated in maturer patients. It is in the neighborhood of twenty years, probably, since D. D. Smith began his epochal experiments in the repeated hand-polishing with orange-wood stick and pumice stone of the deciduous teeth of a few young children. So marked seemed to be the benefits from the procedure that it was applied to the crowns and the necks of the teeth of adults. In time, a number of patients were undergoing monthly "prophylaxis" treatment in this simple manner, and Dr. Smith began to publish statements and to read papers respecting the results gained. These results not only included marked improvement of the local tissues, but it was believed that serious constitutional derangements were benefited or cured. In addition, the members of a committee were quoted as saying that they had seen examples of health and beauty of the gums and teeth in some of Dr. Smith's patients excelling any they had yet examined. It is now fifteen years since I learned through the *Dental Digest,* then edited by our late Dr. Crouse, of the adventures in a new field by Dr. Smith; and they were taken at their face value. If dentists had not been so tremendously industrious in devising methods for the replacing of lost dental tissues, it would be hard to explain the nearly unbroken silence of writers, teachers and practitioners respecting the merit of Dr. Smith's work. It is refreshing, therefore, to find Pickerill saying that: "D. D. Smith, of Philadelphia, has of recent years

elaborated what may be termed the apotheosis of mechanical prophylaxis," and that the results, which are said to be excellent, are doubtless brought about by the decreased tendency of food-stuffs to lodge upon highly polished surfaces.

Naturally, efforts have been made to shorten the time of treatment by resorting to power-driven buffs, rubber cups and brushes carrying a series of materials calculated to bring out the latent lustre and develop "slipperiness" of the exposed tooth surface. This last term is favored as bringing graphically to mind a condition through which stasis is most positively discouraged.

Dr. A. W. Ward's Results.

It seems probable that the methods of the lapidary may be profitably imitated, and it is gratifying to be able to state that Dr. A. W. Ward, San Francisco, is able to offer a contribution to what promises to become an increasingly delightful art through his devising of a series of laps and buffs, and polishing materials which may be dispensed in tubes. Indeed, it was while seeking to obtain some of those materials that I unexpectedly was able to see in Dr. Ward's office some natural dentures that showed such marked improvement in health and beauty in so brief a time after treatment as to be startling and to lead one to desire to labor after like achievements. Pockets extending well toward the root apices had apparently been healed after one treatment and without the use of drugs. The exposed cemental structure had been thoroughly and cautiously planed with drawcut instruments and polished with materials carried on tapes. The enamel had been relieved of rough irregularities and brought to a lustrous state of smoothness and polish.

Cases Treated by the Author.

I have been endeavoring to obtain corresponding results in such advanced cases as have come under my care, and more especially in those more commonplace cases that are not advanced, and so do not at present, at least, secure such marked expressions of praise. Still there has been in my care recently a lad of eleven years who was afflicted with acute ulcerous gingivitis, that painful affliction originally described by Dr. Thomas L. Gilmer in the *Dental Review,* Vol. 20, 1906. The description is also to be found in the work of Dr. G. V. I. Brown (*"Oral Surgery"*) and in the new volume by Dr. Black *"Special Dental Pathology."* The lad had been scarcely able to eat for a week because of pain; there was a slight evening rise of temperature; the gums of the oral teeth and bicuspids were swollen and painful to touch and bled freely. The treatment consisted of careful washing of the gums and tooth surfaces with tepid salt solution from a bulb syringe and the local application of

trichlor-acetic acid, diluted. He was supplied with a bulb syringe for cleansing the teeth over the next day, which was Sunday, and directed to use local application of tincture of iodine of half strength. On the third day the results observed were gratifying indeed. The temperature rise, which had been daily, had ceased, the swelling had decreased and the pain abated. The patches in front of the tonsils, which had also been treated with trichlor-acetic acid, dilute, had decreased and no new areas of infection had occurred in the molar region as would have been the usual course. Indeed, there seemed no reason why the parents and lad should not proceed immediately on their two-weeks' homeward journey, which they did. The promise of such rapid and complete recovery came from just one condition, and that was because he had been receiving for six years frequent prophylaxis treatment under the direction of Dr. Robin Adair, of Atlanta. The enamel surfaces were smooth and lustrous to the state of slipperiness and it was possible to cleanse them in a liberal degree with a stream from the bulb syringe. Here was startling confirmation of the need of seeing that Nature's product, the enamel, should receive the attention due it through artificial means. The lad's case was in striking contrast to two cases of acute ulcerous gingivitis in young men treated by me a number of years ago. In both, the gums were greatly swollen and could be lifted away from the denuded and exposed root surfaces. There was a gray necrotic condition of the margins, pain was marked and the course in the milder case was six weeks.

Case II.

A simple case demonstrating the need of enamel treatment has been recently noted in a young man in his early twenties. His teeth were of a dense and pleasing quality, demanding little reparative work. He neglected to come for three years and points of hemorrhage were noted from the septal tissues between the lower second bicuspids and first molars. In scaling I was able to dislodge and bring to view a minute scale of serumal calculus from the mesial surface of either molar. The buccal surface of the right molar was found to be free from calculus, but the gingival territory was rough to the scaler and therefore was planed and polished. The left molar had a smoother buccal surface and had apparently benefited by the more vigorous right-handed brushing. These marginal beginnings of socket tissue disturbance and destruction in the mouth of a young man with teeth above the average, and with exemplary habits of living, teach one a significant lesson. We can only hope that the Forsyth and Eastman Infirmaries and wise and generous commonwealths everywhere will provide preventive treatment for the thousands instead of, as now, we provide for the isolated few in private practices.

Treatment for Sensitiveness at Tooth Neck.

In the badly denuded root surfaces there is often need for remedies for sensitiveness to touch and to temperature changes. The promptest and most agreeable one that I have found has been the tannin and alcohol solution of slightly syrupy consistency, which was recommended in the *Dental Cosmos* some half-dozen years ago. The next is the potassium carbonate in glycerin of Dr. Flagg, twenty grains to the drachm; and there are the old tried remedies of zinc chloride or silver nitrate. There remains to be considered the essential home treatment of the teeth. I could wish that all might have heard and witnessed the exhaustive clinic, talk and demonstration of our colleague, Dr. Jules J. Sarrazin, on Tuesday, on this subject, which could only be given by one who had devoted thought, time and energy to the subject.

The Home Care of the Teeth.

It is my own custom to ask patients to cultivate the "hand-glass habit" and examine the teeth frequently after brushing. They are instructed to place some of Dr. Jenkins' tooth paste on a *dry* brush, which is then dipped in a *dry* powder from a box having a broad cover. This is carried to the mouth without the addition of water. The lingual surfaces of the upper teeth receive the first dry application in the morning and the lingual surfaces of the lower teeth receive the first dry application in the evening; upper, morning; lower, night. In a few seconds the mouth will be supplied with a copious flow of saliva and all of the surfaces can be gone over seriatim. We have here an alkaline preparation which, contrary to Prof. Pickerill's general rule, is a salivary excitant instead of a salivary depressant. I will make a demonstration of this quality at the close. The patients are instructed to brush the gums as much or more than the teeth, as the latter will be covered anyway. The brush is turned laterally from the apical territory toward the crowns with a firm, sweeping turn of the wrist, and an effort is made to secure a variety of movements. The patients are told that to derive any benefit from the benzoic acid and saccharin of the Jenkins' formula, at least one minute would be required in the laboratory and that several would be required in the mouth. That seems to make an impression, and a suggestion is then made that a watch or clock be used to control the time. Tooth pastes have always seemed to me to have but a problematical value as being slippery in themselves, and mouth washes I have grown to use only for astringent purposes, and that seldom. As time passes, the mechanical element looms higher and higher as the one

to be trusted. Certainly, until we have exhausted its possibilities, our findings cannot be clear ones. The Jenkins formula I have taken in a measure on faith, because of the good name of Dr. Jenkins, and in the hope that the laboratory tests may be repeated, in part at least, in the mouth. After one uses a tooth paste alone, the glycerine or the soap content gives for a brief period a sense of extreme smoothness; but such a feeling is not persistent. A dry powder brushing, on the contrary, gives a quite lasting sense of smoothness. The combination of dry brush, paste and dry powder has proved a happy one in my hands. To make such a combination convenient, I have had the simple powder of precipitated chalk, 2½ parts; carbonate of magnesia, 1 part, and orris root, ½ part, placed in square boxes with full-width covers. The tooth brush used is one fashioned by me some twenty-five years ago from a large brush. The bristle portion measures 1 3/16 in. by 7/16 in., and it is an excellent size for general use. I frequently direct, in addition, a Prophylactic brush with hard bristles and flexible handle. Three brushes are to be ready so that thorough dryness may be assured. These two forms will, with rare exceptions, reach the various surfaces. From time to time, if food deposits are noticed, the mouth-mirror and hand-glass are produced and the patient's attention is directed to the deposits. The patient will be assisted in gaining the mechanical idea of cleansing if the dentist's moistened forefinger is carried over the neglected or difficult surfaces, such as the lingual of the lower molars, and the disto-buccal of the upper third molars. For the cleansing of these latter teeth the patient is warned to open the mouth but a short distance to avoid the forcing away action of the ramus of the mandible. Indeed, a large service may be rendered if the dentist will demonstrate the "dry method" in his own mouth in the presence of the patient. The oval bulb water syringe is sometimes provided as directed by Professor Black. The Ideal Bridge Brush seems excellent in some cases, and I shall be interested to test the promising merits of the little double-end brush designed by Dr. Jules Sarrazin, of New Orleans.

Post-Graduate Study Classes Advocated.

Before closing I desire to venture an expression of belief in the value of team and class-work instruction in developing a vastly greater interest in the everyday and systematic scaling and polishing of the teeth by undergraduates and practitioners. This belief has been fostered by having been a member of a class of instruction in cavity preparation and in gold foil operations, and later in a class of instruction in the planing of the rough tooth surfaces and the securing

of a high state of lustre by tapes, buffs, and so forth. In these and other classes concentrating on definite subjects great enthusiasm for accurate and successful effort is developed, and permanent study clubs are often established. If certain hours in each week of the dental curriculum could be set apart to be devoted exclusively to oral prophylaxis under an expert teacher, that which has so long constituted the *opprobrium dentarium* might be minimized. It goes without saying that an advance in skill on the part of individual practitioners may well accompany public efforts for oral hygiene and prophylaxis.

Hygiene of the Bucco-Dental Cavity as an Important Auxiliary for the Prophylaxis of Incipient Bucco-Pulmonary Tuberculosis.

By Ernesto A. Dam, D.D.S., Lima, Peru.

Considering that the bucco-dental cavity is the principal channel for the introduction of food as well as other elements for the nutrition and healthy maintenance of life in our complex organism; considering that on account of its special situation and connections it fulfils a special office in the respiratory functions of the lungs; and considering the excessively polimicrobicidal condition of the mouth, we can easily understand the favorable conditions which it affords for the reception, propagation and development of the Koch bacillus, whether it comes from outside, introduced by the different infecting external agents or whether it is incubated inside by the internal diastasic agents, either congenital or acquired after birth. The above considerations will also enable us to appreciate the very great importance of constant, methodical and absolute hygiene, and the great prophylactic advantages to be derived by a careful attention to the same in order to prevent the invasion and germination of this terrible scourge of humanity and enemy of mankind.

If we consider the enormous number of septic mouths to be found throughout the world, the greater part of which have more or less dental caries in different degrees of infection, and which therefore must greatly increase the normal polymicrobism of the buccal cavity, through which the food is constantly passed to the digestive canal in order that it may be assimilated and thus contribute to the nutrition and maintenance of our tissues, blood and system in general; that in such condition the food is received by the juices and digestive organs of the stomach, all of which are found in such bad septic conditions; that as a general thing the food cannot in any way be guaranteed as free from all risk of infection or exempt from such risk, such as raw or insufficiently cooked meat, and which, as has been demonstrated, often contains tuberculous germs (Testut), cold milk that has not previously been boiled, and more or less adulterated, raw eggs, etc.; that our lips and mouths form excellent

soil for the seizure and culture of the Koch bacillus; that our hands are not always sufficiently free from the presence of micro-organisms, either developed or undeveloped, and that at any moment may result in an unexpected attack by the Koch bacillus; that these dangers are more specially found in the dust that is collected by our clothing or even that of other persons which we may have touched, as well as from other articles which we may have touched, or those contained in the dust of our parks, roads, streets, and houses, in which is contained the dust of the dried sputa of tuberculosis patients; I repeat that if we bear in mind these constant dangers, we cannot but recognize the important necessity of buccal hygiene.

When the food and other elements of nutrition and life are passed through the buccal cavity under such conditions—and with still greater reason if there is any considerable debilitation of the normal organic resistance which would present a formidable obstacle against the entrance of the infecting agent into our system—as I before said, they may add germs of still greater virulence which would contribute their assistance in the attack and progressive evolution of the Koch bacillus, that is received first in the stomach and afterwards in the lungs, whence it is transported through the blood vessels over the entire system. In this condition of incipient vitality the germs find themselves in a highly favorable medium for their germination, reproduction and multiple development, all assisted by the air which is constantly received in the lungs and which is the first requisite for their nutrition and progressive maintenance.

Now, if we bear in mind that certain affections or diastasic conditions facilitate the attack, development and progress of tuberculous germs, and which consist of nervous and chronic affections, enlargement of the stomach, diabetis, rheumatism, anaemia, alcoholism, syphilis, etc., we can still further appreciate the great importance of giving proper attention to the healthy preservation of our internal economy by careful attention to the cleanliness of the bucco-dental cavity in general, as a wise means for counteracting the formidable scourge which is offered by tuberculosis, which, as is well known, can only be kept off by daily and strict prophylactic hygiene that is never neglected and that will deprive the Koch bacillus of a favorable soil for its reception and development.

The Importance of Mouth Hygiene During Infancy and Early Childhood.

By Horace L. Howe, D.D.S., D.M.D., Boston, Mass.
Instructor in Orthodontia, Harvard University Dental School.

The best safeguard against diseases of all kinds is the high standard of health.

How to get and maintain a high standard of health is the concern of the whole nation.

It is the object of this paper to point out a few of the factors concerned in bad mouth conditions and to offer a few suggestions for the remedying of the lamentable conditions found among our school children.

A broken-down set of teeth in childhood is a serious menace to the child and a great handicap in the future career of the individual.

It is fast being shown that the greatest carriers of diseases are the human beings themselves and the mouth is the great harboring place for germs of all kinds.

In several institutions in Boston the infectious diseases of childhood have been practically eliminated by giving dental care and enforcing mouth hygiene daily after the teeth were put into good condition.

In Strassburg, Germany, through the efforts of Dr. Jessen, a public school clinic has been in operation for ten years.

To show the good results of this clinic, 2,000 school children, about eight years of age, were examined and compared with 2,000 children of the same age from a district in Berlin far from a clinic so that the children had no free dental care.

In Strassburg, 54.3 per cent. of these children had healthy first permanent molars, compared with 7.5 per cent. from Berlin.

The larger percentage of healthy first permanent molars in the children of Strassburg is a great step in advance in safeguarding the health of the children and a monument to the work of Dr. Jessen.

In the City of Boston there are 128,000 school children.

"Twelve thousand, or more than one-tenth of the total number, will die of tuberculosis alone unless the death rate is reduced. A large num-

ber will die before reaching the age of twenty-five, before they become producers.

"A conservative estimate places the cost at $3,000,000 for elementary education* alone for those children that will give no return to the community." If dental care could be instituted in the earlier grades at school, it is safe to say that much of this loss could be saved, as it costs from $50.00 to $75.00 a year to maintain a child in school.

Every city and town should install in every school building means for instruction and care of the teeth. The object of education is the training for efficient citizenship.

What better could be taught the child than to know how to safeguard his health?

It would be economy for the Commonwealth to conserve the health of its child units in every possible way, as the nation is strong only as the individual units are strong and healthy.

Effects of Eating Candy.

A factor concerned in the cause of bad mouth conditions that should not be underestimated is the food and habits of eating.

When one considers that there is in Boston one candy factory that sells one hundred tons of candy on an average each day of the year, we can understand how great the candy habit is becoming.

Two hundred thousand pounds of candy a day from one factory, and there are many factories in Boston alone!

This candy habit is an important cause undermining the health of the American child to-day. In our cities there is a shop for dispensing cheap candy opposite almost every schoolhouse. If the candy traffic could be regulated as is the liquor traffic, it would be a source of good. In Boston no saloon can be operated within a certain number of yards of a schoolhouse. The same law might be applied for the selling of candy, as candy is as great an evil to the child as is liquor to the adult.

Cleansing and Use of Nasal Passages.

Included in bad mouth conditions are the narrow, undeveloped jaws with the narrow, blocked, undeveloped nose.

To teach the public that these conditions are unnecessary and the result of ignorance should be included in the campaign of prevention.

The nose should be used from infancy for breathing; should be kept clear of mucus and secretions; should be cleansed daily with a pledget of cotton saturated with oil.

*From the address of Edward McSweeney, Trustee of the Boston Consumptive Hospital, at the dedication of the Forsyth Infirmary for Children.

If this is done the nose will be used and the stream of air going back and forth will perform the function of ventilating and clearing the whole internal head, including the ears.

Also the importance of breast feeding should be taught the public. The normal means of feeding is a source of stimulation for development which can be had in no other way.

The importance of so directing the career of the child from infancy to avoid bad mouth conditions is the greatest hope of the future. To avoid trouble is better than trying to remedy defects.

Existing conditions must be met and treated, but prevention is the true keynote of success.

The United States Indian Service Field Dental Corps.

A New Field of Activity in Which Physician, Dentist and Teacher Collaborate.

(A Preliminary Report Showing What the Federal Authorities Are Doing to Develop a Thorough Oral Hygiene Campaign Among the American Indians.)

By. Fdo. E. Rodriguez, D.D.S.
Field Dentist and Oral Hygiene Lecturer, United States Indian Service.

The recent researches into the etiology of various human ailments, which to a great extent still defy scientific determination, point toward the human mouth as an eminently important focus of infection or as a nidus, which under certain conditions harbors a thriving flora of micro-organic life, always on the "qui vive" to deal a death blow at any of the vital processes when conditions of bodily resistance give way to out-numbering disease-producing germs. The best medical thought of the day and the remarkable researches by the leaders of the dental profession voice unanimously the sentiment for greater, more efficacious co-operation between the two agencies in charge of promoting the health of the nation, namely, the physician and the dentist.

Such is the idea that fortunately permeates through all the progressive institutions of the land and the steps already taken by State and municipal bodies to bring about a betterment of oral conditions, especially among school children, not to mention the introduction as part of the staff of hospitals and sanatoria, of dental hygienists, brings us to a happy realization that modern dentistry is a powerful ally, a new force in the realm of prevention to be reckoned with by the time-honored medical profession in the combatting of disease.

Of the Federal institutions to recognize at an early date the benefits to be derived from this new field of health activity, following the footsteps of the Army and Navy branches, the United States Office of Indian Affairs deserves the congratulations from the interested elements of both healing professions for having introduced this new phase of prevention measures into their plan of health work. It may not be amiss to say that this bureau of the National Government is vested by Congress with the power of managing the affairs, as well as promoting the education

and health of the 300,000 Indians which form the present population, scattered over an immense area of the national domain. This requires the annual expenditure of a large appropriation having for its ultimate end the preparation of the remnants of this once strong and vigorous race for the privileges of citizenship. But the prevention of disease and the maintenance of health is naturally one of the foremost policies of the Federal authorities, for civilization carries with it certain responsibilities and the conditions to be met require knowledge and intelligent compliance with certain well established laws of health. The Health Department of the United States Indian Service is therefore an extensive organization employing a large number of physicians, specialists along certain medical and surgical lines, trained nurses and field visiting matrons. To this corps a number of dentists has been added, thus forming a complete equipment of field health workers whose need of co-operation was quickly realized. The dentist and the physician are most happily brought together, working side by side, each in his own sphere, but both mutually co-operating toward the same end. I do not know of any other field of health work where results are so decisive or more quickly attained through sane and scientific consideration of the long neglected oral cavity in its relation to systemic disease.

Outline of Measures Introduced.

The oral hygiene measures introduced in the U. S. Indian Service may be briefly summarized as follows:

1. Appointment of traveling field dentists who will visit and institute oral hygiene measures in all schools for Indian education.

2. Dental prophylactic treatment compulsory to all pupils enrolled in Indian schools.

3. Dental restorative treatment by field dentists to all pupils in need of such free of charge, by following the same procedures as practiced in the leading dental infirmaries of the country.

4. The "Dental Record" of each pupil to be filed with his other health records and retained at the school for future reference as part of the official files.

5. Regular illustrated lectures on oral hygiene to be given by field dentists to school children and adults as part of their regular duties in all assignments.

6. Special lectures by field dentists to teachers, physicians, nurses and field visiting matrons on the subject of Preventive Dentistry.

7. Tooth brush drills introduced as part of the regular duties of

teachers, and clinics given by dentists in order to improve the technique in the proper cleaning of the mouth and teeth.

8. Introduction as part of the regular curriculum of a course in oral hygiene and text-books on physiology and hygiene to be selected according to extent and suitability of chapters devoted to the anatomy, physiology and hygiene of the teeth.

9. Every government school to be equipped with sterilizable tooth brush racks or cases where brushes may be kept clean and easy of access and identification by owners.

10. Necessary amount of tooth powder and tooth brushes to be made object of special requisition in annual estimates—the usual wear and tear to be carefully considered in order to avoid possible shortage.

The conditions reported by dentists has led the medical authorities to submit various recommendations in regard to personnel required and several other steps. The following recommendations are now under advisement by the Indian Office officials:

(a) Increase of dental force to at least twenty-five dentists.

(b) Appointment of regular dental trained nurses to assist dentists in preliminary examinations, prophylactic treatments, recording of work, appointments, etc.

(c) Selection of one of the Government warehouses as a dental depot wherein materials constantly required be kept on hand to insure prompt delivery on short notice as required by the men in the field.

Considering the broad-mindedness displayed by the Washington authorities in all these measures that tend to the betterment of Indian child life, these recommendations will be met in the near future. The dental service of this branch of the Government is as yet in its infancy, and what has been accomplished, with the funds available by the Commissioner of Indian Affairs, is deserving of the highest credit.

Field Dentists.

Before proceeding any further I will, for the sake of information to any dental surgeon desiring the experience in the future, state that dentists or field dentists, as we are officially designated in this service, are appointed after showing their competency in an examination conducted by and under the rules of the U. S. Civil Service. They are first appointed for a probationary period of six months, at the end of which, if services are satisfactory, they receive appointment as permanent employees. The entrance salary is $1,500 a year, besides actual expenses of subsistence, heat, light and quarters when stationed at any place. When traveling under orders we are allowed actual necessary traveling

expenses, including sleeping carfare and incidentals, and besides, subsistence not to exceed $3 a day. The position is equivalent to a substantial private practice, and for anyone desirous of constant travel and not much attached to home comforts it is an ideal position. Annual leave to the extent of thirty days, not including Sundays and Saturdays half-day, is permitted during the summer period. The work is devoted strictly among school children while the schools are in session, the balance to observation and treatment of adult reservation Indians. Dentists are issued a complete field dental outfit, including materials for a quarter of a year's work, and materials are furnished as required on request to the central office in Washington. We are free to choose our materials from the catalogues of the leading manufacturers of the country. In this the Washington office has been liberal, and any justifiable request is promptly met if available funds permit.

Pyorrhea Alveolaris and Tuberculosis the Two Greatest Scourges Affecting the Vitality of the American Indian.

In accordance with Government reports, tuberculosis is reported to be the great enemy of the Indian, and to this end the Federal authorities are carrying on a most efficient and intense campaign against the most dreaded affliction that has considerably thinned the ranks of the picturesque race aboriginal of this land. The most approved methods of modern therapy, coupled with the slogan of "prevention through education of better living conditions," are being used. But a new problem, hitherto unthought of, and the control of which will perhaps decide if the fight will be effectively won, is the almost universal prevalence of pyorrhea, especially among the adult Indians. The "disease of mystery" at present so much in the public mind, due to the remarkable experiments and claims of several researchers, is present in its most virulent and destructive forms in not less than 80 per cent. of the Indians occupying the southwestern portion of the country (territory recently covered by the writer), and reports from other dentists in different sections are to the same effect. In my judgment, and after tabulated facts in co-operation with Government physicians in regard to systemic lesions having a probable origin from these extremely septic mouth conditions, pyorrhea occupies to-day, along with tuberculosis, the place of honor in being one of the greatest scourges affecting the vitality of the American Indian.

The dental profession has reached a stage, in so far as this disease is concerned, in which a new theory as to its etiology, treatment etc., is advocated or advanced with almost every-day frequency. It is not my

intention to advance any views as to the most favorably reported method of treatment in our territory, as being outside the scope of a paper of this character; yet my attention has been called to the fact of how little our dental writers dwell on the infective and possibly contagious nature of this disease. If my experience in observing closely nearly 3,000 Indians affected (an opportunity that very seldom falls to the lot of the average practitioner) can still be carried to a further point as we desire, we expect to submit to the profession—backed up by sufficient and conclusive data—observations to the effect that:

Pyorrhea Transmissible.

1. Pyorrhea is transmitted from person to person along the same principles that govern the familiar infectious, local and general diseases.

2. That proper preventive measures at home will avoid the unusual prevalence of gingival infection, which is nothing else but incipient pyorrhea, among school children, which, in our territory we have observed to originate at their homes in 100 per cent. of the cases. The above are facts deserving the attention of our researchers and dental hygienists, and in my mind it is time the public should be instructed to take precautionary measures to avoid contagion either by direct or indirect contact with pyorrhetic persons.

That pyorrhea is a disease of filth, as claimed by many, is undoubtedly true since among many persons no other causative factor can be found and give the condition of reduced resistance of tissues occasioned by septic accumulations. But that pyorrhea is also and with the same clinical picture of virulence and destruction found among persons exercising the most rigorous rules of oral hygiene, as the average observant dentist knows, leaves no doubt in our minds that the theory of spontaneous occurrences by vicariousness, as having origin in some remote systemic disturbance, is far from universal acceptation. That perfect mouth cleanliness is not a safeguard against the enroachment of pyorrhea is as true as the fact that strict general body hygiene is not an immunizing barrier against any acute infection when duly exposed to its influence directly or indirectly. In this connection I wish to quote the following lines from that most illuminating series of researches conducted by Dr. Hartzell, of the Research Committee of the N. D. A. After pointing out in a remarkable manner the possibility of direct infection through the gingival cul-de-sac, he says: "Has systematic oral prophylaxis taught us anything upon which we may depend regarding this matter?" And continues: "Certainly there must be a rational explanation for the fact that inflammation of the gingival margin invariably precedes deeper infection of the tissues in the neighborhood of the human teeth."

After extensive observations among the Indians, including both adult and children, it has been conclusively noted that pyorrhea is more common among children whose parents are afflicted in any degree than among those whose other family members are not affected. It also has been observed that children given a clean bill of mouth health while at school where strict oral hygiene is enforced were found to present varying degrees of gingival infection on their return to school after having spent vacation at their homes, where bad mouth conditions prevailed.

The interest displayed by the Federal authorities in the control of this disease, and in general for a thorough mouth hygiene campaign, is better illustrated by the following communication sent to one of the Superintendents of the Service suggesting plans for relief:

To Superintendent Pima Reservation, Arizona.

Dear Sir:

On account of the extreme prevalence of pyorrhea among the Pima Indians, and the serious effect it has upon the health and vitality of the tribe I wish to recommend that a systematic and continuous effort be made to prevent its further spread and to place under treatment as many of those who are suffering from the disease as possible.

The practical preventive measures may be briefly summarized as follows:

1. Educational campaign on oral hygiene.
   Talks by teachers and physicians in all schools.
   Posters or notices sent to Indians and employees.
2. Daily tooth brush drills in all schools.
3. Frequent inspection of oral hygiene conditions.

The treatment which can be administered by the physician in the absence of a dentist consists of local applications to the gums, systemic treatment when necessary, and local instrumentation with the use of dental scaling instruments. I have requested Dr. F. E. Rodriguez to submit a list of scalers that may be used by the physicians and to leave definite instructions in regard to their use and subsequent treatment. If regular appointments can be arranged for at the different villages for the treatment of cases by the physician and field matron, much good can be accomplished. The field matron should be instructed to assist in this work, and should do her utmost to encourage the use of the tooth brush in the homes and to influence the Indians to take treatment.

The following notice is suggested as appropriate for distribution over the Reservation:

Pyorrhea!!!

Pyorrhea is a very serious disease of the teeth and gums. It is due to small pieces of spoiled food and hard matter which collects on the teeth and up under the gums if they are not kept clean. This matter causes the gums to swell and become painful and tender, and finally causes them to shrink away from the teeth. The pus constantly runs into the mouth and is swallowed all the time. The teeth become loose and may fall out.

Pus is a poison, and when it is swallowed or taken into the body it weakens it and leads to stomach trouble, rheumatism, heart trouble, and sometimes tuberculosis.

The proper chewing of the food is also prevented because of tenderness and pain in the gums.

Treatment!!!

If treatment is taken early the disease may be cured, but if neglected it becomes worse and the teeth may be lost. The hard matter under the gums must be removed from the teeth by the doctor or dentist before the disease will be better, and then the teeth must be brushed every day.

If you have sore gums, bad breath, loose teeth, or pus around the teeth, go to the doctor or dentist and have the teeth treated.

Prevention!!!

Brush the teeth night and morning every day, and have everyone in the family do so. This will keep the teeth in good condition, will prevent pyorrhea and decay, and will keep the body healthy and strong.

All field workers should be interested in this matter and should be instructed to co-operate in every possible way.

JOSEPH A. MURPHY, Medical Supervisor.

The above is presented to show the method of bringing the matter in an understandable way to both school authorities and Indians. This campaign has brought prompt response from school officials as well as from the Indians in general. Local medicinal and instrumental treatment along the lines advocated by Hartzell and Talbot has been the most favored method in our territory, although the advent of emetin hydrochloride as a possible specific has considerably diverted our attention toward this new line of treatment. The Commissioner of Indian Affairs has given instructions to the end that the drug be tested in order to determine the claimed efficacy in the treatment of pyorrhea, and ample quantities have been sent to the field workers for their use and observation. The communication that follows shows the interest manifested in this matter:

Office of Indian Affairs, Washington.

To All Superintendents:

Articles have been published from time to time in the *Journal of the American Medical Association* and elsewhere relative to the specific cause of pyorrhea (commonly known as Rigg's disease), which many now believe to be the endamœba. If this is true, it would appear that in the preparations of ipecac there may be an easy and simple method of ridding the mouths of Indian pupils of this disease.

Physicians are instructed to observe the prevalence of this disease in their jurisdictions, keeping a record of its presence or its absence among all adults and pupils under their care for the next six months, submitting a report of their findings to this office at the close of this period. Whenever possible, these studies should be supplemented by microscopical examinations. In this connection physicians should institute all possible prophylactic and therapeutic measures in accordance with the recent advancement in the treatment of this disease. Requests for the purchase of the ipecac preparations used in the treatment of pyorrhea will be honored as far as available funds will permit. Superintendents should furnish physicians with a copy of this circular.

CATO SELLS, Commissioner.

It would be too early to advance at present any views as to the efficacy of emetin, although the instructions given out by the Commissioner are being carefully observed and experiments and observations are being recorded. It is expected that when the statements from the investigations be received, the results tabulated and the complete final report made, it will be the most extensive and exhaustive report of experiments ever attempted in pyorrhea work, covering territory in almost every State west of the Mississippi River. The method adopted in the territory assigned to the writer may be summarized in the following steps:

(a) Local injections into gum tissues along lines recommended by Barret and Smith.

(b) Hypodermatic or intra-muscular injections along lines advocated by Bass and Johns.

(c) Combination of above with local instrumental and medicinal treatment along lines advocated by Hartzell and Talbot.

Prevalence of Dental Caries Among Indian School Children.

The present enrollment of pupils in the Government schools for Indian education, boarding, day and missionary, is of about 30,000 children, ranging in age from 6 to 20 years. Each boarding school is assigned one resident physician, and the other smaller schools are looked after

by sub-agency physicians located within reasonable distances from the schools and at points centrally located within the reservation. Considering the large enrollment, the number of physicians required and actually employed, the territory to be covered, and, furthermore, the conditions found, the seven dentists at present authorized by Congress form a very inadequate force with which to fully contend with the conditions found. However, with the plans formulated by the office, dentists are assigned to worst districts primarily and the services of physicians, nurses and matrons enlisted in co-operating in the work.

I have not been able to secure at this early date a complete record of the dental conditions all through the service, although informal advices from some of the dentists point toward an unusual prevalence of dental caries among school children and accompanying local and general disturbances due to infection and malnutrition. In the territory recently covered by myself (Southwest) a careful compilation of data obtained after examination of 2,430 children, is as follows:

Age	Caries	Associated Infections
6	92%	80%
6-10	90%	80%
10-12	82%	76%
12-15	77%	75%
15-20	46%	35%

As seen by above compilation by percentage, the prevalence of dental decay and premature loss of organs is as alarming as the figures obtained from the white schools of various sections. The statements advanced by some writers on this subject seem to indicate the white child as the great victim of dental caries, pointing to the aboriginal races as immune to the inroads of the disease, due to the consumption of fibrous food (meat, fruits (which exert a self-cleansing action on the masticatory organs. It should be remembered, however, that the American Indian of to-day has emerged into a quasi-civilized stage, using to a great extent the white man's methods and undergoing a radical change in his habits of food preparation and consumption. This is due to both Governmental influence and the influence of the nearby white man. It is a noticeable fact that among the old generation relatively perfect and apparently sound dentures are found, and this is no doubt due to lessened carbohydrate material in the food, coupled with the use of foods requiring perfect mastication. The further from the influence of modern methods of life, the better the record has been of relative absence of decay, and in many families examined in the remotest parts of the Reservation a

small percentage was noted in great contrast with those living in the neighborhood of Government agencies or centres of white population.

The success of a mouth hygiene campaign, as demonstrated by those remarkable and far-reaching series of experiments conducted at Cleveland under the leadership of Dr. Ebersole, depends on the combined efforts of teachers, physicians, dentists, parents, educational authorities; in fact, every one of the agencies having to do with conservation or preparation of child life for an efficient citizenship. The Indian health officials have been aware of this necessity of bringing the matter clearly before all concerned. It may interest those working along these lines to read the following letter sent in the interests of better oral hygiene to several teachers for their guidance:

To All School Teachers:

I wish to call your attention to the necessity for more thorough oral cleanliness among the pupils at the school under your charge, and to this end I am requesting you to make it part of your regular duties to conduct daily tooth brush drills. In conducting this drill, divide into five steps, and always follow them in the same consecutive order as follows:

1. *RINSE MOUTH THOROUGHLY WITH WATER.*
   Place small amount of powder in left hand, moisten brush and dip in powder.
2. *RIGHT SIDE* (6 steps).
   (a) Outer side, upper teeth. Brush downwards.....8 times
   (b) Outer side, lower teeth. Brush upwards.....8 times
   (c) Inner side, upper teeth. Brush downwards.....8 times
   (d) Inner side, lower teeth. Brush upwards.....8 times
   (e) Grinding surfaces, upper teeth:
   Brush back-forth, 4 times. Crosswise.....4 times
   (f) Grinding surfaces, lower teeth:
   Brush back-forth, 4 times. Crosswise.....4 times
3. *LEFT SIDE* (6 steps).
   Moisten brush with water, dip in powder and take same steps (a to f) as on right side.
4. *FRONT TEETH* (4 steps).
   Moisten brush with water, dip in powder and take same steps (a to d inc.) as on right side.
5. *RINSE MOUTH THOROUGHLY WITH WATER. RINSE BRUSH.*

See that the teeth are brushed by *vertical strokes,* from gum to biting surfaces, as already explained, inside and outside alike, and only one jaw at a time. Never allow them to brush crosswise, except over the grinding surfaces of molars, as otherwise food particles will remain between or great injury may be worked on the enamel surface.

Investigation has been made of the condition of the teeth of the Indians on this Reservation, and 80 per cent. of adults, as well as a large percentage of children, have been found to be suffering with pyorrhea. The cause of this disease is the neglect of the proper cleanliness of the teeth resulting in the formation under the gum margins of deposits which irritate the gums, causing infection, pus formation, recession of the gums, and loosening of the teeth. The constant absorption of the pus poisons the system, interferes with digestion and lowers the resistance to disease. This is a serious condition and can only be properly combatted by teaching and insisting upon proper oral cleanliness on the part of the rising generation.

Instruct your pupils in regard to above facts and teach them that a healthy mouth means better digestion; better digestion means better health; better health means a stronger, abler child, greater freedom from disease and consequently better school work. Use your influence in encouraging them to procure and use the tooth brush daily in their homes.

Your hearty co-operation in carrying out a campaign for better mouth cleanliness is earnestly required.

Very truly yours,

SUPERINTENDENT.

"Mottled Enamel" or "Brown Stain" an Endemic Affection Among Certain Indian Tribes.

This peculiarity of the enamel has been found to occur in a large percentage of the Indians living within certain areas of the Southwest. The Pima Indians of Arizona, among whom the writer traveled extensively on a recent tour of duty, are perhaps the ones most intensely affected with this peculiar coloration of the teeth. As a field dentist in the Government service it became my duty to observe the prevalence of the condition as well as to bring the matter to the attention of the Health Department. The question of brown stains of the enamel is apparently very little known to the profession at large, when the literature in the subject is consulted, which is almost nil. The description of the condition is described in the following communication to the Medical Supervisor of the Service:

Brown Stain on Teeth of Indians.

"I have the honor to bring before you one of the most serious problems which, from a dental point of view, confronts the majority of the Indian population of this State—the solution of which is difficult with the available means.

"We have before us the fact that fully 70 per cent., in some localities as high as 90 per cent. of the teeth of the Indians are discolored (blackened) to such an extent as to totally destroy the normal appearance

of the masticatory organs. This is being a source of queries, not only from those directly affected, but also from other quarters startled by this unusual and obviously unfortunate affliction.

"From personal observation during the last five months' tour of duty among the Pima and Papago tribes, I may safely state that the above figures are nearly correct; that this destructive agent of the normal beauty and appearance of the teeth most insidiously attacks young and old, and that it is resistant to all well-known dental bleaching processes.

"The stain referred to is a deep brown coloration of the enamel portion or outer protective layers of the tooth structure. In many instances it appears to be diversified with still deeper brownish-blackish areas, affecting most prominently the lower and upper anterior teeth and to a lesser degree the occlusal surfaces of the posterior organs. The discoloration varies both in intensity and location—in some cases the incisal edge being the only affected; in others, the total labial, incisal and occasionally lingual surfaces of the tooth crown. The stain varies from a slight straw to a deep, intense brownish-blackish pigmentation.

"From a crude or superficial investigation, histologically it appears to be a deep pigmentation of the inter-prismatic cementing substance of the enamel layer. The infiltration does not take place during the period of deciduous dentition, but makes its appearance during or soon after the secondary or permanent dentition. This may, perhaps, preclude the consideration of any changes caused by nutritional disturbances in early childhood or intra-uterine influences.

"It seems to be, therefore, a purely post-eruptive occurrence undoubtedly associated with certain geographical locations and modes of life as to intensity and occurrence.

"Among the young children brought under my observation in the course of my official duties I have observed an early predisposition of the tooth substance as shown in the abnormally white, rather chalky appearance of the permanent teeth. This lack of the normal translucency or lustre is undoubtedly due to a change of the refractive index, which affirms my belief that actual changes are taking place in early life.

"The condition in its entirety is a source of deep concern, especially so among the better educated younger generation. Once acquired, it apparently marks the victim for a lifetime.

"Up to the present I have been unable to trace whether or not this stain is a causal factor or associated with other dental diseases. It may be the latter, although the fact that it is found in otherwise sound and healthy dentures in about as many would tend to preclude this theory.

"Nevertheless, the subject deserves our consideration from a scientific point. Whether this affliction is due to an infiltration of contaminated water supply, use of certain wild vegetation as food, high alkalinity of the soil, or some obscure disturbances in early childhood, remains to be solved. May I request that the co-operation of a qualified scientist or dental pathologist be enlisted to investigate the cause and possible eradication and prevention of this condition?"

Looking over the literature in the matter of stain I find that Dr. H. A. Fynn, of Colorado Springs, years ago studied the condition, and a paper to this effect was published in the January edition of ITEMS OF INTEREST for 1910. I do not know if the condition referred to in Dr. Fynn's paper is the same I have seen among the Indians, but there is a striking similarity in his description that tallies with what I have observed. However, the cause assigned by him is far from acceptation when every angle is carefully studied so far as it relates to the Indians. Recently Dr. Fred S. McKay, of Colorado, has been investigating the matter, and paid a visit to the Pima Reservation to obtain data in regard to the prevalence of the stain at that point. The fact that Dr. McKay will read a paper on this subject has aroused our interest considerably, and let us hope that considerable light will be thrown on the subject. This no doubt will be so, given the qualifications of the gentleman and of Dr. Black, his collaborator, of professional fame.

Observations conducted in the Pima Reservation have conclusively shown that the stain is not causative of disintegration or related in any way to other dental affections. The demand for teeth from certain quarters has been great, and men have even gone to the extent of offering to pay highly for an extracted tooth. Suggestions like this have not even been shown the courtesy of a reply, for besides showing lack of professional ethics it puts the Indians in a bad light so far as believing that they will lose an otherwise precious organ for a small consideration and to meet the whims of a dentist. Any clandestine methods will be watched, and if possible any case of these cases of gross malpractice will be dealt with by the Federal courts.

Not long ago a dental quack advertised among the Indians that he was the possessor of a secret formula with which he could eradicate this stain in a short time with few applications of that marvelous specific. Fortunately, only two cases were reached by him, and in both cases, beside the stain, the whole structure of the teeth treated crumbled to pieces. We could not disclose the identity of the dentist, for he traveled fast to avoid the local officials on his trail. Men of this calibre are a disgrace to the profession of dentistry, and I believe it is time for the National Dental Association to take steps to expose these cases of "quackery." This question is of interest from a professional or scientific point, and any man qualified by his knowledge of dental pathology who may desire to investigate will be shown every possible courtesy.

In closing these notes on what the United States Indian Service is doing for the benefit of Indian child welfare, let us hope that the day is near when every public or private institution shall have introduced

compulsory dental treatment as a health measure. Nowhere is the interest of the Federal officials better illustrated than in the following lines quoted from a letter of the Hon. Cato Sells, Commissioner of Indian Affairs:

"The care of the teeth is a matter of vital importance in connection with maintaining or improving the health of the Indian children in our schools. The instructions heretofore given admit of no misunderstanding, and superintendents and all others responsible for seeing that the children in our schools give proper care to their teeth will be held strictly responsible for failure to comply with the spirit and letter of instructions."

Papers Presented in Section V.

Materia Medica and Therapeutics.

Opening Address.

By J. P. Buckley, Ph.G., D.D.S., Chicago, Illinois.

Ladies and Gentlemen:

The Officers of Section Five of the Panama-Pacific Dental Congress, which section includes the subjects of "Materia Medica and Therapeutics," welcome you to their deliberations. Our essayists and discussers have all been chosen because of their special training and fitness to discuss the subject selected; and a glance at our program will show that many vital problems before our profession are here to be considered.

Conductive anesthesia, in all of its relations to dental surgery, will be described and illustrated in the minutest detail. The superstitions of dental medicine will be discussed by a man whom we all admire, and who is well able to handle the subject. Pain in its relation to diagnosis, and the importance of its alleviation and prevention will be the theme of one of our essayists. That most vital question, "what shall be done with pulpless teeth?" will not only be considered, but, better than this, the question will be answered; and what is still better, the answer will not contain the statement that in order to conserve the general health of the patient, these teeth must be extracted. Methods and means of treating pulpless teeth and filling root canals, together with the necessary surgery in the successful management of such cases, will be outlined; and the results, by radiographic findings, will be shown to be so perfect from the standpoint of health, comfort and service that physicians and dentists in the future will repeat with caution the statement of Henry L. Ulrich*, a physician of Minneapolis, in which he implied, if he did not say in so many words, that all pulpless teeth should better be removed. Quoting from the paper he says:

Ulrich's Views on Oral Infection.

"Every tip of a devitalized tooth whether the root canal has been properly or improperly filled becomes a *locus resistancii minorii.*" To justify this conclusion the Doctor further states, "I am inclined to generalize that prior to the days of devitalization

Dental Review, December, 1914.

of teeth, chronic rheumatic conditions were less frequent. Several generations ago, it was the custom to have a faulty mouth corrected by extracting teeth and substituting plates. To-day every possible tooth is saved with the consequent penalty, in the large group who are sensitized to streptococcic invasion, of the possibility of these areas becoming store houses, or foci, for the streptococci, from which they spread out in periodic showers, in joints, muscles and periarticular tissues, to say nothing of the heart, appendix, kidney, prostate, and mucous membrane of the digestive tract. The X-ray has done medicine a wonderful service in detailing this focus to our attention; for often it is the only stand which has been overlooked and its removal closes the incident for future trouble. Again this focus may yield the material which keeps the patient submerged in a subacute streptococcic invasion. It holds the balance of power. Its removal again gives the body its opportunity to close the chronic fight for complete sterilization."

Buckley's Views on Oral Infection.

In quoting the above from Doctor Ulrich's paper I do not wish to be misunderstood. What he has said about the health-value of removing focal infection is all too true; but I do wish to state, with all the emphasis at my command, that the majority of teeth thus involved, may be therapeutically or surgically treated so that they will not be a menace to the health of the individual.

Physicians and dentists should work together and in harmony on this proposition. The former should not advise the extraction of teeth without first consulting the latter. When focal infection is found, or suspected in the mouth by the medical practitioner, his plain duty lies in referring the patient back to the family dentist with such suggestions as he may deem advisable in the case; thereby permitting the member or members of the two professions to work together harmoniously for the benefit of the patient's health.

In our discussion of this, which I consider the most vital question confronting us to-day, let us be fair to all concerned, and not endeavor to shift our responsibility. You know and I know that in the past many hopelessly diseased teeth have been retained in utter disregard to the possible deleterious effects they may have on the general health. This will not be true of the dentistry of the future. That classic, though at the time, much criticized article of Sir William Hunter started both the professions of medicine and dentistry thinking seriously along this line; and to-day we have a better understanding of what focal infection means, whether the focus is about the teeth, the tonsils, or the toes. The profession of medicine is safe with its Hunter, Billings, Rosenow, Murphy,

Mayos, and others. Likewise our own profession will not go far astray with men like Price, Hartzel., Callahan, Rhein, Ottolengui, Grieves, Brophy, Gilmer, Logan, Moorehead, and a score of others whose names could well be mentioned in connection with this work.

Root Canal Pastes Condemned.

Our profession from to-day on will not countenance nor tolerate the filling of root canals with the much heralded zinc oxid-formaldehyd paste, which material, thus used, is responsible for more abscesses about the roots of teeth than any other one factor. I unhesitatingly make this statement in full recognition of the fact that I have been for years and am now an ardent advocate of the proper use of formaldehyd in the treatment of teeth wherein its use is indicated. From now on we will treat and fill the canals of pulpless teeth after the methods of the men who know—not after the methods advocated by the manufacturers of these so-called quick and sure abscess cures, with their glaring catch phrase "permanently antiseptic." Personally, I have been too busy in life to have trained myself to see the clouds; but I frankly admit that at times I have felt somewhat discouraged with the effort I have endeavored to make to place the treatment of pulpless teeth on a rational and scientific basis. Too many men have been following the "easy way" and have listened to the siren call of those who have deceived and mislead them for personal aggrandizement. The X-Ray is as valuable to dentistry as it is to medicine; and by this means we are shown the dire results of our own folly in handling pulpless teeth. But I have never been accused of being a pessimist. To-day I am happy to say that I am privileged to stand back where I can see above and beyond the clouds; where I can observe the radiant sunshine, with its stimulating rays and its elevating influence; and from this viewpoint, I see the dental journals of the future making their advertising pages as free from questionable root canal filling materials and other questionable advertisements as are the pages of the *Journal of the American Medical Association,* or our own *Journal of the National Dental Association.*

But I must hasten on. There are other subjects which I wish briefly to consider at this time. I have tarried on the subject of pulpless teeth because it is one on which I have spent many years of my life.

The Use of Emetin in Pyorrhea.

About one year ago the professions of medicine and dentistry became deeply interested in the announcement of Barrett and Smith, of Philadelphia, that they had discovered in a certain endamœba (*E. buccalis*) the cause of pyorrhea; and that they had found emetin hydrochlorid to be a specific for this disease. Closely

following the above announcement, we learned of the work along this line by Bass and Johns, of New Orleans. These men practically corroborated the statements of Barrett and Smith that amœbas are the cause of and emetin hydrochlorid a specific for pyorrhea. Bass and Johns used the remedy largely internally, while Barrett and Smith confined its use to the pyorrheal pocket. The result of this announcement has been such that we find more physicians than dentists to-day treating this dental disease, using emetin hydrochlorid alone; and in most instances absolutely ignoring the faulty mouth conditions which aggravate, if indeed they do not actually cause the disease, regardless of the presence of amœbas.

My private practice is confined largely to surgical, prophylactic and pyorrheal work. I have now used emetin in every manner in which it has been suggested, both in college and in private practice; and I can say that there is no longer any doubt in my mind about the efficacy of the drug. Used locally, as suggested by Barrett and Smith, in my hands, the remedy has been disappointing; but the results are surely noticeable when the drug is internally administered as suggested by Bass and Johns. There are two ways by which this may be accomplished: By the hypodermic injection of emetin hydrochlorid, and by the mouth administration of Alcresta ipecac. The latter is an absorption compound of the alkaloids of ipecac with a form of hydrated aluminum silicate after the method of Professor John Uri Lloyd, of Cincinnati. This combination prevents the alkaloids from being dissolved in acid or neutral solutions and permits their solution in alkaline media. Thus in this manner the alkaloids pass through the stomach unchanged, preventing entirely the nausea and vomiting which follows the oral administration of the preparations of ipecac or emetin in any other form. So far as I have been able to observe there is little, if any, difference in the results obtained by these two means of getting the drug into the circulation where the blood stream carries it to the alveolar lesions. Because of the ease of accomplishment, the mouth administration is far preferable, and the results equally as good.

My present opinion regarding the "emetin treatment" for pyorrhea is that the remedy is *not a specific for the disease.* In itself, used as physicians use it, without the all-important local treatment, it will not, in my hands, cure the disease; but used internally as the surgical treatment is undertaken and accomplished, the inflammation subsides more readily, the gums resume their normal color and tone more quickly, and the teeth and mouth generally feel more comfortable than when the drug is not administered. I believe the future will develop that emetin when internally administered has some therapeutic effect, other than its amœbacidal action, which makes its use valuable in the treatment of certain mouth conditions. It may be its hemostatic action upon the blood.

The remedy is equally efficacious for flabby and bleeding gums and all other inflammatory conditions resulting from local irritants. It must be remembered, however, that no remedy should be administered for such conditions without a thorough prophylactic treatment of the mouth. When Bass made the statement* that 95% of all adults examined by him had pyorrhea, he must have used the term in a broad sense, including gingivitis and all inflammatory mouth conditions. Strickly speaking these conditions should not be classed as pyorrhea.

Elimination of Pain in Dental Operations.

There is one more subject which I wish to discuss with you at the opening of this Section, and that is the elimination of pain in dental operations. The dentist of the future must operate with less pain than has been done in the past. This fact has been recognized for some time; and three distinct methods of accomplishing this end have been suggested: Viz., analgesia by nitrous oxid and oxygen; interosseous and conductive anesthesia by cocain-adrenalin, or what seems to be the more popular preparation—novocain-suprarenin; and by the use of a preparation recently introduced by myself and known as "Desensitizing Paste." It is not my desire nor intention to dwell upon the superiority of any one of these methods or remedies over the other; they have all been introduced for the purpose of eliminating pain in dental operations; and, under the conditions which should govern the use of each, they serve their purpose well.

Desensitizing Paste.

The use of Desensitizing Paste is necessarily confined to operations upon vital teeth, and the ease with which it is used, makes it far more practical in the hands of the average man for work of this kind. However, just in proportion to the ease with which the remedy may be used, is it likely to be abused; and it is because of this fact that I am referring to Desensitizing Paste at this time.

It is not necessary to use these pain-relieving methods in all cases of cavity preparation in vital teeth. I am sure that the average practitioner does not use analgesia, conductive or interosseous anesthesia in the larger percentage of cases; neither did I intend to have Desensitizing Paste used in every case. The use of all such means, in my opinion, should be confined to those cases of *hypersensitive dentin* where the pulp of the tooth is uninvolved and where permanent work cannot be done without the infliction of more pain than we are justified in causing to-day with these different methods at our command.

Before giving Desensitizing Paste to the profession, I realized that

*Journal of the American Medical Association, February 13, 1915.

it would likely be used where it was contraindicated; but I felt then as I do now, that this possibility should not deter me from placing this valuable remedy in the hands of those men who would carefully study the conditions and use it with care and judgment. The preparation was given every test, including the conclusive test of time, to ascertain whether or not it is a safe and reliable remedy to be used for the purpose for which it is intended. A great deal of experimenting was done by myself in the laboratory, and after the formula was worked out, it was given every clinical test both by myself and other reliable men. It was found that the remedy will not affect sound dentin to any appreciable depth; and if used in cases where there is sound and healthy dentin intervening between the cavity of decay and the pulp proper, the remedy will not reach and affect the pulp.

It is an easy matter for those who are suspicious of the permanent effects of Desensitizing Paste upon the pulp to determine for themselves whether or not sensation returns in dentin which has once been desensitized by the remedy. If the preparation is applied to and sealed in contact with exposed sensitive areas at the necks of teeth for a period of twenty-four hours or longer, it will be found that the sensitiveness is completely destroyed. It will also be found that in about three weeks' time the sensation will begin to recur and in five or six weeks the areas in most cases will be as sensitive as they were before the preparation had been used. In fact the effect of Desensitizing Paste on sound dentin is so transitory that I have practically abandoned its use for sensitive necks of teeth, preferring to use other means which will produce more permanent results.

Another clinical test which any dentist who is interested may make and thus satisfy himself as to whether or not Desensitizing Paste will reach and affect the pulp in those cases where it is indicated is the following: Frequently a tooth will present where there is a sensitive cavity on either side, neither one being sufficiently deep to involve the pulp. If Desensitizing Paste is sealed in one cavity and the other left open, it will be found that the dentin in the cavity to which the remedy has been applied will be completely desensitized while the cavity which was left open is as sensitive as ever. I and others have made this test repeatedly, and it seems to me that no more conclusive test as to the effects of the remedy upon the pulp could be applied.

It has now been nearly a year since I read my first paper on Desensitizing Paste; and I can well repeat the closing paragraph in which I said: "In offering this valuable remedy to the profession, I wish specifically to call attention to the fact that every dentist has had cases in his practice

where vital teeth have ached after permanent fillings have been inserted, and that pulps die occasionally following these operations. Unless the dentist is well posted on pulp pathology and is cautious in his diagnosis similar experiences will follow the use of Desensitizing Paste. If such should be the case, however, it will be through no fault of the remedy—it will be the fault of a mistaken diagnosis. I can understand how much harm can follow the use of any remedy or method by which cavities may be painlessly prepared. In the hands of the careless operator pulps may be left in which should have been removed. In the hands of that great army of conscientious practitioners, who constitute the vast majority, Desensitizing Paste will lighten their burden and prove its worth."

I have now directed your attention to what I have considered the most important problems, relating to this Section, before our profession to-day. In closing I simply want to say that through the development of the sciences of pathology and pharmacology we have learned that it is unnecessary to exhaust our materia medica in prescribing for any one disease; and with this more definite knowledge of the action and effect of drugs upon the tissues, organs and functions of the body, we find that only a few drugs can be employed with actual benefit in our endeavor to aid nature in restoring an abnormal to a normal condition.

Since I began the practice of dentistry, I have secretly harbored the belief that dental therapeutics is of sufficient importance to occupy a place by itself; and to this end I have labored diligently for sixteen years, hoping and confidently expecting that some bright day, in the not far distant future, this subject might ultimately be divorced from operative dentistry, to which it has long been subordinated. It pleases me greatly, therefore, to realize that the dawn of this day is here. If you will follow closely the deliberations of this Congress, not only in this Section, but in all Sections, you must observe that the future of our profession rests largely upon the prophylactic, therapeutic and surgical phases of our work. We want you to attend every session of this Section, and we can assure you in advance that your time will be well spent.

"Bad Canal Work:" What Shall We Do About It?

By Howard R. Raper, D.D.S., Indianapolis, Ind.

We shall do better canal work and we shall do less canal work. That is the answer. Now for a twenty minute discussion of the matter.

I could not have chosen a more hackneyed title than the one I write under. Tons of paper, barrels of ink and miles of lead pencils have been used by dental essayists considering this subject. However, the problem of canal work is the most important and the most unsettled one with which dentists are concerned.

I am a radiodontist,* that is, I make radiographs of the teeth and contiguous parts, and so I see canal work and the problems of canal work in a comparatively new light—the light of the X-rays. As the point of observation changes, the appearance of the problem or the object observed may change also, and our deductions and opinions vary accordingly, which is the reason why I, a practitioner of radiodontia, write about the subject of canal work.

In the first place, I take it that we can agree that there is such a thing as bad canal work, *i. e.,* canal work which fails to eradicate or prevent foci of infection at the apices of roots. In fact, most canal work is of this kind. I state this dispassionately as a fact, not in the spirit of reprimand, and I would have you know that I do not agree at all with the man who says "Our canal work is a disgrace." It may be a mistake, but it is not a disgrace. Mirl Stro says, "It is no disgrace to wear rags; the disgrace lies in continuing to wear them." Likewise, it is no disgrace to make a mistake; the disgrace lies in continuing to make the same mistake.

Until recently, canal work was considered successful if it prevented subsequent toothache, and, measured by this standard, it has been successful. But the extensive use of the radiograph and the theory of metastatic infection set a new standard: Pulp canal work must not only

*The word radiodontist and radiodontia have been coined by the writer. A radiodontist is one who practices radiodontia, and radiodontia is the science and art of making and interpreting radiographs of the teeth and contiguous parts.

prevent subsequent toothache, it must also prevent subsequent periapical foci of infection. Methods which fulfill the requirements of the old standard fail to meet those of the new, so they must be discarded and replaced by methods which do prevent the development of foci of infection, such methods for example as those advocated by Callahan.

This places the average dentist in a rather difficult position. As Dr. Harry Carr facetiously expresses it, "If he does his canal work as he has been doing it, he gives his patients heart trouble. If he takes the time necessary, and does it as he now believes it should be done, he gives them heart failure—when he presents his bill." This is funny because it is so pathetically true. Fees for canal work which has for its aim only the prevention of further toothache are only about one-fifth the amount which must be charged for canal work which is calculated to prevent subsequent periapical infection. Yet the fact remains, the more expensive methods must be adopted and practiced by all ethical dentists.

"But how?" cries the average dentist. "I cannot do this work unless I am paid for it, and my patients either will not or cannot pay me."

The patient who could but will not pay for good canal work gives me little concern. Such a patient is either impervious to reason or he or she has not had the matter presented in the proper light.

But patients who actually cannot afford the work (and there are thousands upon thousands of them) do give me much concern. Many people cannot afford good canal work because they need so much of it. If they had less of it to be done, they could afford it. And, note this; it is important. Canal work becomes necessary when a tooth aches, and most toothache is *preventable.*

And so we arrive where every thinking man arrives if he gives this problem of canal work sufficient consideration. We see that something must be done to prevent conditions which necessitate canal operations. We arrive at this conclusion if we consider the problem from a financial aspect, as I have just considered it; we arrive at this same conclusion if we consider the disasters of poor canal work or the difficulties or short-comings of the best canal work; and we arrive at this same conclusion if we consider the unnecessary pain suffered and the waste of time and energy.

Something must be done to prevent conditions which necessitate canal work. That is, something must be done to stop the practice, common with most people, of deliberately allowing their teeth to ache before patronizing a dentist, instead of visiting him periodically and allowing him to fill and refill their teeth as soon as cavities appear, and so prevent the occurrence of toothache and the necessity of canal operations.

The thing which must be done is to educate the people to a better understanding of the folly of allowing their teeth to ache.

It would take years to accomplish this by lectures, tracts, magazine articles, newspaper articles, and personal advice, but it can be accomplished in between twenty-four and forty-eight months by a publicity campaign conducted by The National Dental Association.

Campaign of Public Education Advocated.

Since we contemplate educating the public, it might be well to stop and consider some of the characteristics of our prospective student, that our efforts at teaching may be governed accordingly. The public as a student is a big, lazy, indifferent duffer, unwilling to learn anything. To teach him, you must amuse him, arouse his curiosity, scare him, or make the lesson so easy that it can be learned without effort. It should be borne in mind, also, that the public has a thousand or so other teachers besides us annoying him: The socialist wishes to educate him to save itself from capitalism; the capitalist wishes to educate him to save itself from socialism; the minister wishes to educate him in right conduct to save his soul; the physical culturist wishes to educate him to save him from physical deterioration; the sex hygienist wishes to educate him to save him from syphilis and gonorrhea, and so on and on. No wonder he is lazy and indifferent. He has to be in self-defense.

If you accept my picture of the public as a student as I have drawn it you will agree with me that it is useless to attempt to teach him a long lesson. It would be futile to attempt to teach him this, for example:

"*Toothache* can be avoided.

"*It can* be avoided if you will visit your dentist at regular intervals and have him fill and refill your teeth as soon as cavities occur.

"*You should* avoid toothache.

"*Because,* to commence with, who wants to suffer with the toothache, anyhow.

"*Because* a tooth which has ached must be treated.

"*Because* the treatment of teeth takes much of your time, and your time is valuable.

"*Because* the treatment of teeth by modern methods is very expensive. (In fact, toothache and the treatment it necessitates is a luxury to be indulged in to any great extent only by the well-to-do.)

"*Because* once a tooth is allowed to ache, there is the chance that you may lose it, and you need all the teeth you have.

"*And because,* unless a tooth which has once ached is properly treated, it may later ruin your health and life by causing rheumatism, heart trouble, gastric ulcer and other serious diseases.

"*So.*

"*Never let your teeth ache.*"

I would like to teach all of the foregoing to the public, and, if I could, it would be the nearest thing to a solution of the problem of canal work we have ever had. But it is impossible to teach so much, and fortunately it is not necessary. A small part of the public will demand the lesson in full as I have just given it, even asking for further elaboration, and we

NEVER LET YOUR TEETH ACHE!
Signed: National Dental Association.
(If you don't know what it means, *ask your dentist.*)

can give it to them, but for the big, big public as a whole, the lesson must be shorter, very much shorter. Something like the lessons taught by the big commercial advertisers, such as "He Hears His Master's Voice," "Eventually, Why Not Now," "There's a Reason," and others.

In the practice of radiodontia I have this problem of canal work brought constantly before me, and I have given much thought to the selection of something sufficiently short to reach the public and yet capable of accomplishing the purpose I wish it to accomplish.

And I have finally decided that the very thing to be used on bill-boards, street car-cards, advertising spaces in the magazines, on the handles of tooth brushes, on tubes containing tooth pastes, anywhere and everywhere where people will see it, is on the sign set in the middle of this page.

Aside from the advantage of brevity, this has the further advantage of arousing the curiosity. When first read, it sounds rather nonsensical, and so gets a second thought from the reader. It allows one who reads it to become facetious with himself and remark to himself, "Fine advice, that. I wonder who thinks I have toothache just for spite." And its greatest advantage is, *it can be remembered.* Even that part of the public which demands its dentists to give it the lesson in full will forget most of the lesson and remember only that there *are* good reasons why you should *never let your teeth ache.*

And so I approach the end of my consideration of bad canal work and what to do about it, and you raise your brows in disappointment and

say, "Perhaps you have told us *what* to do, but you have not told us yet just how to do it nor where to commence."

Unless you have already done so, commence by acquainting yourself with the methods of treatment advocated by such men as Callahan, Rhein, Buckley, Biddle, Best, and Ottolengui, and apply these methods in your practice in so far as your ability and social and economic conditions will permit you. Overcome any inability by hard work and deal with the sociologic and economic phase of the subject through the National Dental Association.

And commence to deal with the sociologic and economic phase of the problem right now by taking the action, as the Section of Materia Medica and Therapeutics, to recommend this paper to the attention and consideration of the Board of Trustees of the National Dental Association.

Even though you see the necessity for publicity work as I see it, and are therefore in favor of it, you may, nevertheless, think that I am asking the National Dental Association to do something it cannot do. Notice, though, I do not ask dentists to do something they cannot do. I do not say to them, "You must adopt more modern and expensive methods of treatment forthwith, and that's all there is to it," for I know that the great amount of canal work to be done makes this an economic impossibility. Neither do I ask the National Dental Association to do something which is economically impossible. What I want it to do, it can do. It can do the publicity work I suggest, and it must. We owe it to humanity and ourselves.

In conclusion, let me leave this thought in your mind: the technical problems of canal work have been fairly well solved, the problem of canal work to be met and solved to-day is essentially an economic one.

Local Anesthesia.

By Dr. Arthur E. Smith, Chicago, Ill.

The goal of medicine and dentistry as practiced to-day is efficient results, backed by thoroughness and accomplished through the medium of clinical research. I am safe in stating that during the last half century there has been incorporated in the scientific records of medical and dental science for the benefit of humanity three great achievements which have no parallel: anesthesia, antisepsis, and a knowledge of antitoxins.

It is true that the untiring and constant search for some agent by which pain might be annihilated is as old as the practice of medicine, and it seems there is no other field in the professions of medicine and dentistry that has held forth such allurement for the investigator and has been so much desired on the part of the patient, of whose feelings on the approach of the surgeon, Tennyson wrote, "sent a chill to my heart when I saw him come in at the door."

It is very gratifying to the members of the professions of medicine and dentistry to compare the most efficient methods for alleviating pain which we have at our disposal to-day with those practiced in years gone by.

Ancient Attempts to Produce Anesthesia.

The principle of inhaling volatile substances to produce analgesia or anesthesia is very ancient; in fact, as old as the practice of medicine itself. In the third century a Chinese surgeon is said to have employed some sort of anesthetic drug, and the Romans used mandrake to stupify criminals at the time of crucifixion. Mandrake was also used as a surgical anesthetic up to the thirteenth century, and its use is mentioned by Galen. A surgeon of Naples also tells of volatile drugs that were used for anesthesia: hyoscyamus, poppy, solanum, and belladonna. These drugs were kept in leaden vessels, and when their fumes were inhaled the individual passed into a most profound slumber and was rendered insensible to pain. Numerous other methods were employed in days gone by, and a constant search has been made for some drug that would fulfill the requirements of an ideal anesthetic.

Discoveries of Wells and Morton.

In the years of 1844-46, Drs. Wells and Morton made known to the world their discoveries of anesthesia produced by nitrous oxid and ether, and this marked the beginning of the real advancement of anesthesia. It was America that presented this great gift to humanity, and the world owes her an everlasting debt of gratitude. From that time until the present day a gradual development has been made, not only in improving the method and technique of the scientific administration of nitrous oxid oxygen and ether, but also in presenting to us other valuable agents for alleviating pain and surgical shock. This gradual advancement of all anesthetics, both local and general, has made anesthesia a distinct science.

Many times anesthesia has been discredited by professional incompetence, and consequently the failure to attain results should in no way discourage the modern trend. It is true that in many cases the lack of proper treatment is the cause of serious results and is therefore little calculated to enhance popular confidence and esteem. When an operator inflicts pain, be he medical or dental practitioner, it not only shows the lack of the proper application of modern methods, but it has a most deplorable effect of creating in the mind of the patient a horror for the treatment that is so necessary for the proper maintenance of health, and for that reason causes loss of popular confidence and esteem.

In years gone by it was the custom to select only one general anesthetic, but modern research has proved that in order to attain the desired goal of a shockless operation it is far better to select a combination of methods, and to follow a definite technique in order to attain the highest ideal.

Reaching the Goal of a Shockless Operation.

The great handicap which has confronted the practitioner of dentistry and which has acted as a stumbling block for rendering efficient service is that which we all dread—pain. A large number of practitioners know that many times they were responsible for producing fear and shock upon their patients in order to accomplish their operative procedures, and have therefore familiarized themselves with and are giving their patients advantage of the recognized methods that science now offers.

Crile's Views.

The clinical research work on shockless operations, accomplished by Dr. Crile, of Cleveland, is really a revelation, and his clinical records prove the value of well-selected methods. He says: "The word anesthesia—meaning 'without feeling'—describes accurately the effect of

inhalation anesthetics. Although no pain is felt in operations under inhalation anesthesia, the nerve impulses set up by surgical operations reach the brain. In this manner traumatic shock is caused. How can we prevent it? On the kinetic theory, no shock could be produced by traumatizing a territory whose nerve connection with the brain has been broken by nerve blocking. By blocking nerve connection, local anesthetics protect the brain against destructive psychic stimulation of the brain cells, and do not exclude the operative stimulation; and anesthetics introduced hypodermically, being uncontrollable, are excluded on principle.

"Each anesthetic covers a part of the field, but there is no single agent that alone can produce anoci-association, which is the goal of operative surgery. We therefore do not advocate ether alone, nor chloroform alone, nor nitrous oxid alone; we do not advocate local anesthesia alone, nor morphine and scopolamine alone, nor spinal anesthesia alone; but through selection and combination of anesthetics we aim to attain an anesthesia that will exclude all stimuli from the brain and thereby attain anoci-association."

Anoci-Association.

In surgery it has been proved that there is no single anesthetic agent that alone can produce anoci-association. Stimuli are carried to the brain by the afferent nerves which cause pathological changes in the brain cells, whether the patient is under a general anesthetic or not.

The patient's fear of the operating room, unsoothing words, and the dread of taking an anesthetic; the rough manipulation of the tissues during the operation, and the ungentle post-operative manipulation; all these things generate harmful stimuli which are sent to the brain and cause detrimental effects, the stored-up energy in the normal brain cells being destroyed.

These harmful stimuli, which in the past have played an important rôle in causing a high mortality rate, are now blocked by the anoci-association method, and in consequence there is a decrease in the mortality rate to an extent one can hardly believe. This new principle excludes all harmful stimuli reaching the brain, and the bad-risk patient has a greater chance to live than the patient who is operated upon without the blocking of these impulses.

Several years ago it was found that the respiratory, cardiac and the vaso-motor centers discharge their energy in response to traumatic stimuli applied to sensitive locations on the body during surgical anesthesia. The central station is awake to the condition and readily responds to the harmful messages, thereby causing physiologic exhaustion. How is this accomplished in modern surgery? It is accomplished through the employment of a combination of methods; they are:

(1) By exclusion of fear and dread of the operation.

(2) By the administration of morphine and scopolamine one hour before the operation.

(3) By the scientific administration of nitrous oxid and oxygen.

(4) By infiltrating the subcutaneous tissue where the incision is to be made with a novocain-suprarenin-Ringer solution.

(5) Careful post-operative treatment.

As soon as the incision is made through the skin, which has previously been anesthetized by a local anesthetic, the fascia and other tissues are next infiltrated and divided. If anesthesia is complete, all sensory nerve endings are paralyzed and no afferent impulses are generated, and complete relaxation of the tissues is secured.

Nerve Blocking.

By the nerve-blocking method the pain inflicted by trauma is relieved and the afferent pain impulses are absent and do not register their detrimental effects upon the brain cells, as is the case when the pain impulses are not blocked. The man at the speaking end of the telephone is ringing his bell, but the bell at the central station is not ringing because the wires between the two 'phones are disconnected. What has been proved to be the result of such technique? A lowering of the mortality rate, and a most gratifying post-operative recovery and comfort to the patient. Dr. Crile says: "No matter how extensive the operation, no matter how sick the patient, no matter what part is involved, if anoci-technique is perfectly carried out, the pulse rate at the end of the operation is the same as at the beginning, and the post-operative rise of temperature, the acceleration of the pulse, the pain, the nausea, and the distension are minimized or wholly prevented."

Dread of Dental Operation.

It is needless to remind you that many of the operations which are daily performed by the dental practitioner are equally as severe in producing pain as many performed by the surgeon for which he employs anesthesia. Is it not just as important that the dental practitioner should endeavor to eliminate detrimental factors from his operations just the same as the modern surgeon? It is true that the operations that the dentist is called upon to perform are not so grave in character as those of general surgery, yet they are just as important, and a patient appreciates the accomplishment of dental service free from pain.

How is it possible to avoid the dread, the fear and the pain caused by dental operations? It can be accomplished through the medium and proper application of novocain-suprarenin-Ringer solution and nitrous oxid and oxygen. When these agents are employed by skillful hands,

the harmful, traumatic and psychic stimuli which cause physiologic exhaustion can be averted. One of the greatest watchwords both in the medical and dental professions is prophylaxis; this is considered to be far more valuable than treatment, and it is self-evident that it is readily applicable in the prevention of shock and collapse.

Numerous things enter into the prophylactic treatment; one of these is the pre-operative environment. The duty of the dentist by no means begins in the operating room when making an examination, but at the time the patient enters the reception room. The patient should be greeted by a tactful, competent assistant, who should by all means be capable of instilling confidence. If this is followed with reassurance by the operator, he would not labor under adverse conditions, as is so frequently the case. An operator's best assurance for the successful accomplishment of his work would be for the operator himself to meet and use diplomatic methods in allaying his mental fear. However, it is unfortunate that the busy operator has not this opportunity, but must entrust his assistant to establish confidence. It is a recognized fact that the emotional factors which produce fear are most vital, and this natural fear of the operation, which is always present to a greater or lesser extent in every individual, is greatly augmented by improper pre-operative environment. Inconsiderate remarks by some one in the office, the sight and sound of instruments, rough handling, all tend to augment the resistance of the patient, who, no doubt, many times is in a condition to become easily excited. The diplomatic operator eliminates these adverse factors through the medium of proper pre-operative environment and accomplishes his ideal through tactful methods. This pre-operative treatment is followed by a most careful operation at the chair, and, if the operation is painful, by the use of a pain-relieving agent.

The Significance of Traumatic and Emotional Shock.

Shock.

We know that an anesthetic is given to inhibit pain in surgery, and one of its most important uses is to prevent shock. Dr. De Ford gives us a good definition for shock, which is as follows: "Shock is a condition of depression, produced by exhaustion of the medullary centers controlling respiration and circulation, by a too sudden, too painful, too forcible, or too prolonged stimulation of the afferent nerves, the essential phenomenon being a diminution of blood pressure."

We can divide shock into two phases, namely, psychical and physical. The etiological factor of psychical or emotional shock is fear and dread of the operation. It is almost a daily occurrence that we meet patients of this type, and we must combat the existing conditions in these cases.

The dread of being hurt is, in a large percentage of cases, as wearing on the nervous system as physical pain, and it is not always the structure involved, but the exhaustion of nerve centers, that causes shock. After the nerve cells have been subjected to pain caused by trauma during dental procedures for a prolonged time, a condition soon supervenes, known as dental fatigue. This dental fatigue of the system differs only in a small degree from collapse or shock. Fear is a factor born of the innumerable injuries in the course of evolution and its phenomena are based upon scientific principles and in many cases may be just as vital to the patient as produced trauma, and may cause physiologic exhaustion.

The skilled dentist of to-day has valuable anesthetics at his command, and the demand that modern civilization is making upon our vital forces is so great that anesthesia is imperatively called for in painful dental operations, and the methods we now have will permit dental service to be performed with a degree of comfort heretofore unattainable. A patient who is laboring under the dominance of fear may have his dischargeable nervous energy used up by this one factor, or by the pain resulting from trauma upon the teeth. This discharge of nervous energy, which we may call dental fatigue, is the physiologic response for the sole purpose of self-preservation, and is a stimulus which causes physiologic exhaustion. Science has taught us that the central nervous system retains an impression of the previous stimulation, and a second stimulation applied at a proper time after the first stimulation adds itself to the retained impression of the first impression. Take, for example, a patient who is suffering pain, and the adequate stimuli are continually repeated by the rapidly revolving bur or by the broach; the new stimulus is received before the previous one has vanished, and in such cases a higher maximum is reached than is possible under a single stimulus. Repeated pain producing stimuli, or a patient laboring under a mental strain such as we meet with in our practice many times, will, if indulged in, drain the receptacle to the dregs; how may this be overcome, and what is a practical application? Proper pre-operative treatment, nerve blocking and general anesthesia. When the proper methods are used, dental fatigue, pain and shock can be eliminated; and it should teach us that there is something more in cavity preparation than mechanical art, and something more in the practice of dentistry than diagnosis, treatments, mechanical and operative work; and it should be regarded as a great stepping-stone toward efficient progress and for the relief of suffering humanity.

Local Anesthesia.

In every case requiring anesthesia we should carefully judge whether local anesthesia is to be used instead of general anesthesia. The nature

of the operation and the physical condition of the patient must always be taken into consideration in selecting the anesthetic to be given, and the anesthetist must not be too hasty in his decision. In recent years modern surgery has recognized the value of local anesthesia, and at the present time extensive operations are being performed under it and its field has been greatly broadend through the vast amount of research work which has been accomplished within recent years.

Much credit is due the large number who have contributed to this important link in anesthesia, especially Braun, the father of local anesthesia; Crile, on anoci-association, and Fischer. Many extensive operations can be performed under nerve blocking, and its field has been greatly broadened by the knowledge that viscera inervated by purely visceral nerves are insensitive and sensation exists only in those which receive branches from the somatic nerves.

In recent years it has been proved that viscera may be cut, sutured and handled without any severe pain if they are not pulled upon. It has been found that in removing an appendix the only pain felt will be when the meso-appendix is pulled upon or adhesions to the parietal peritoneum are separated. Some of the greatest advantages of operating under nerve blocking are freedom from the danger of anesthetic accident, blood changes and post-anesthetic discomfort and dangers.

Disadvantages of Local Anesthesia.

The disadvantage of local anesthesia is the knowledge of the patient as to what is taking place, and this may be overcome in nearly every case if the anesthetist is tactful, masterful and assuring and engages the patient in conversation. Many surgeons are now employing local anesthesia with satisfaction in the following cases: Appendicitis, radical cure of hernia, strangulated hernia, as well as other forms of hernia, empyema, typhoid perforation, gastrostomy, tracheotomy, goiter, rib-resection, inguinal colostomy, various amputations, varicocele, hydrocele, circumcision, tuberculous glands of neck, drainage of cysts, ligation of arteries, as well as numerous other surgical operations.

Cocain.

The application of a drug to the mucous membrane or skin for the elimination of pain is as old as the practice of surgery; for example, the use of highly volatile drugs as a refrigerating spray was used quite extensively until Koller in 1884 introduced the use of cocain hydrochloride. This date went down in history as the beginning of local anesthesia.

A great many deaths occurring from cocain and the idiosyncrasy many possessed against the drug caused much research work for a drug endowed with a less toxic effect yet capable of the same anesthetizing

power. Within the province of dentistry, oral surgery, as well as general surgery, in which operative intervention demands an anesthetic, research workers have sought for an agent whereby the nerve endings supplying circumscribed areas could be blocked with safety, and the operation be performed while the patient is fully conscious. Such hope has been realized through the medium of nerve blocking.

It is now possible by following well-defined technique to block nerve trunks and to accomplish our work in a most satisfactory manner with the patient free from pain.

Local Anesthesia.

Local anesthesia may be produced by two methods: First, by inhibiting the function of the terminal endings of the peripheral nerves. This renders these terminal nerves within a "circumscribed area" incapable of transmitting painful afferent impulses, and is termed "terminal anesthesia." Second: By blocking the nerve trunk or trunks at some distant point from the field of operation. The point detrmined upon for blocking the nerve trunk or trunks may be in any desirable location between the peripheral nerve ending and the brain. This is known as "nerve blocking"; however, some operators term this conductive anesthesia.

Nerve Blocking.

Nerve blocking anesthesia may be produced by perineurial or endoneurial injections. In the perineurial injections the solution is injected into the tissues near the nerve trunk and the anesthetic solution infiltrates through the perineurium, which anesthetizes the neurones. In the endoneurial method the needle should pierce the nerve sheath and the solution is injected into the nerve trunk proper. The perineurial method is preferable; however, the same requires a few minutes longer to produce complete anesthesia of the central neurones. No doubt the perineurial method is better than the endoneurial method of puncturing the nerve trunk. It is rather difficult to ascertain whether or not the point of the needle is inserted into the nerve trunk during nerve blocking injections. I have never experienced the slightest difficulty in this respect from neuritis or prolonged anesthesia.

Requirements for Nerve Blocking.

The specialist or practitioner taking up the various forms of local anesthesia, and more especially nerve blocking, must appreciate that it involves many important details, and that each step is a well-defined and separate feature and that neglect or oversight in any of the details may result in unsatisfactory results.

The following should be observed in order to obtain the best results:

1. Strict adherence to asepsis.

2. A thorough knowledge of the anatomical parts.

3. Carefully selected equipment.

4. The use of an isotonic anesthetic solution composed of ingredients corresponding to the physiological laws of osmotic pressure and functions of the living cell.

5. Thorough familiarity with all phases of the technique.

6. Judicious selection of the correct method to be employed in each individual case.

7. Diagnosis of any and all existing conditions.

When very weak solutions of cocain were used by the infiltration methods, intoxications were still encountered, and later on a small amount of the extract secured from the suprarenal gland was added, and it was found by combining the two drugs that the extract not only enhanced the anesthesia in a circumscribed area by producing an almost bloodless field, but it made possible the employment of a much weaker solution and prevented to a considerable extent the absorption of the anesthetic.

Novocain.

Clinical records show that the use of cocain, even in the hands of the most skilled, has many times caused disastrous results due to its toxicity, and it is now classed among the dangerous drugs. Of the large number of substitutes for cocain, it seemed that none was capable of fulfilling the requirements of an ideal local anesthetic until novocain was discovered and synthetically prepared in 1905. The consensus of opinion is that this drug, combined with the extract of the suprarenal gland or synthetic suprarenin in Ringer's solution, is practically non-toxic, fulfills the requirements, and is ideal for local anesthesia.

Properties Requisite in The Solution.

The injecting solution should possess the following properties for conductive and infiltration anesthesia:

1. It should not produce irritation nor cause injury to the tissue. It should be absorbed without causing any reaction, such as inflammation, hyperemia, or necrosis.

2. When injected, its temperature should be near the body temperature.

3. The solution should contain an accurate amount of the anesthetic, suprarenin and Ringer's constituents, and should not give an acid reaction.

4. It must be isotonic with the blood and should contain the smallest percentage of the anesthetic agent to render the part anesthetic.

5. It should be free from harmful admixtures and less toxic than cocain.

6. It should be compatible with synthetic suprarenin, practically

identical with the active principle of the suprarenal gland, or adrenalin itself.

7. The injecting solution should be absolutely sterile.

Results show that novocain has the same paraylzing action on the peripheral nerve ending as cocain, and when properly prepared produces no irritation and its toxic effect is almost nil. Braun states that novo-

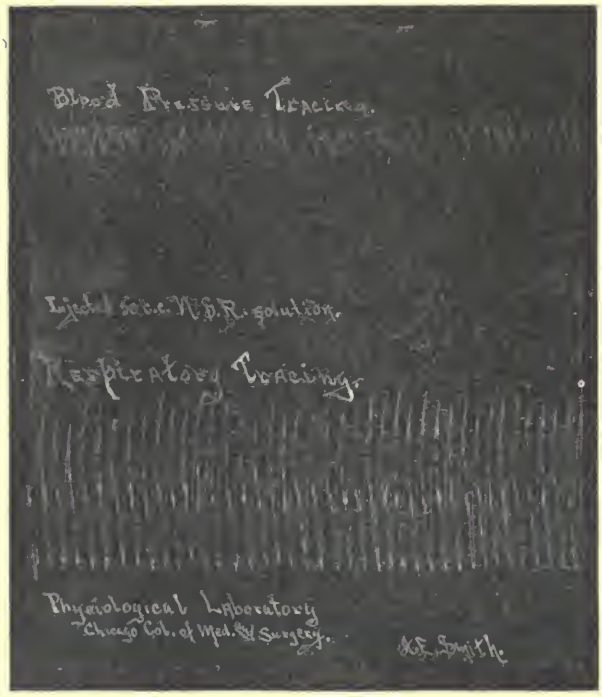

Figure 1—Shows a kymographic tracing of blood pressure and respiration which were taken simultaneously on a dog by the writer. The tracing shows a normal blood pressure and respiration after fifty cubic centimeters of a 2% Novocain-Suprarenin-Ringer solution was injected into the animal.

cain is seven times less toxic than cocain and three times less toxic than its other substitutes. From personal experience with this drug I have found that in normal doses it has practically no action whatever upon the heart or respiration, and its general after-effects after its absorption can hardly be detected, for neither the cardiac nor respiratory centers are influenced.

From personal experience in clinical research, I have found by injecting a two per cent. solution in an amount exceeding the quantity nec-

essary in any dental operation, that there is no noticeable effect on the kymographic tracings of respiration and blood pressure.

Experiments.

At the present time, Dr. L. C. Emenhiser and myself, under the personal direction of Prof. W. D. Zoethout, are carrying out a series of experiments in the physiological laboratory of the Chicago College of Medicine and Surgery. These experiments are being carried out upon animals, and in practical cases upon patients. Various quantities and concentrations of the solution are injected into animals under different conditions, and the results of the injections are registered by the kymograph. Up to this time our results have been most gratifying as varying quantities of the injected solution show practically no effect upon respiration and blood pressure (Fig. 1). Our research findings when completed will be printed in the *American Journal of Physiology.*

This report will undoubtedly be of much value to those interested in local anesthesia and research work. We also hope to discourage the promiscuous use of local anesthetic preparations containing unknown formulas, or preparations compounded from ingredients not recognized by the U. S. Pharmacopœia or Dispensatory. Many dentists are inclined to inject solutions of unknown formulas and unknown toxicity into patients, and we earnestly hope to make a comparative report on the toxicity and pharmacological effect of as many different preparations as may be secured and to attempt to discourage the use of those preparations not withstanding proper tests.

Effects of Novocain and Suprarenin.

Novocain, by itself, causes a slight vaso-dilation which is counteracted by the addition of suprarenal extract and its anesthetizing power is considerably strengthened by this mixture. The suprarenin, which is secured from the suprarenal gland, or the synthetically prepared suprarenin, has the power of causing a vaso-constriction of the arterioles within the injected area, which causes a slow absorption of the drugs, thereby maintaining anesthesia for a considerable length of time. The vaso-constriction readily retards absorption and, under these conditions, the area of anesthesia is restricted to the field of injection. The combination of these two drugs is ideal; for the behavior of each drug is advantageous in nerve blocking. The amount of vaso-constriction is of utmost importance, as this determines the anesthetizing intensity of the novocain to a greater or lesser degree.

Preparation of the Injecting Solution.

It is necessary that the anesthetic solution be most carefully prepared; the drugs must be of the purest quality, and the solution must be sterile; by no means should it be allowed to come in contact with any impurities during its preparation.

Personally, I employ a two per cent. solution in the majority of my operations; however, I have used a one per cent. solution in a number of complicated cases and the results have been most gratifying. With children and delicate individuals possessing an impaired physical condition, the one per cent. solution is found very efficient. Two vehicles may be used in making up the local anesthetic solution; they are physiological saline and Ringer's solution. I prefer Ringer's solution because it contains, in addition to sodium chloride, KCl and $CaCl_2$, which causes it to conform more closely to the chloride composition of the blood. It is a well-known fact, that the inorganic salts are elements whose stimulating influence upon the heart-beat is most striking, and last but not least are absolutely essential in producing an isotonic solution. A striking difference in the action of physiological saline and Ringer's solution, is observed in physiological experiments. If the heart of a frog or terrapin is bathed with a solution of physiological saline it will be found that it stimulates the beat for a short while, but it soon grows weaker, and then if a solution containing a proper mixture of sodium, calcium, and potassium chlorides is added, the beat is stimulated to a marked degree, and can be maintained for several hours. It is a recognized fact that these salts exercise an important part in the production of a rythmical beating heart, and experiments prove that each has its special rôle.

Freshly Distilled Water Recommended.

Only fresh distilled water should be used, and the best distilled water will be obtained by each operator preparing what he uses. It is better and more satisfactory if the dentist has his own still and prepares a small quantity of distilled water every few days, and much better than to purchase distilled water at a drug store. Many druggists obtain their supply from a laundry or ice plant, and upon tests being made, quite frequently the water will be found to be contaminated and some fine cultures of bacteria can be obtained from the same by inoculating culture media from many of the specimens.

When preparing the injecting solution, the novocain dissolver is filled with an excess of distilled water. It is then held over the flame and brought to the boiling point and so maintained for at least five minutes. Then the excess water should be poured off and the quantity

to be injected, retained in the dissolver. To each cubic centimeter add one novocain-suprarenin-Ringer's tablet. This tablet contains sufficient novocain to give a two per cent. solution and sufficient suprarenin to cause vaso-constriction of the blood vessels to hold the anesthesia for approximately one hour, and the correct proportions of Ringer's constituents to render an isotonic solution. This is all accomplished by adding the one tablet. After the desired number of tablets have been added to the vehicle it is raised to the boiling point. If Ringer's solution is kept as a stock solution and each amount used is boiled for five minutes a certain amount of the water is lost owing to evaporation and the once isotonic Ringer's solution is changed to a hypertonic solution. A number of severe and exacting tests have been made in our research work by injecting different quantities and percentages into animals and recording the results of respiration and blood pressure upon the kymograph, and in all the tests both chemical and physiological in the laboratory and in thousands of practical injections upon patients by well-known operators, the results have been very gratifying and in every way satisfactory.

I use a two cc. special syringe equipped with a removable hub and seven iridio-platinum needles. These needles are sufficient for all injections, both intraoral and extraoral and vary in length and diameter The syringe and needles are sterilized in boiling water after each operation, and then are placed in a solution of seventy per cent. alcohol. I employ a glass sterilizer, free from metal and equipped with a porcelain rack, for syringes, novocain dissolvers, pliers, lancet and extra needles. Upon removing the syringe from the alcohol solution, distilled water is drawn into the syringe and care is taken to remove all traces of alcohol. Before making an injection the needle is passed into the flame and brought to a white heat to burn off all alcohol and to thoroughly sterilize it. The needle is now dipped into the crucible containing the injecting solution, and the syringe is filled, taking great care to protect the needle from contamination.

Preparation of the Patient for Local Anesthesia and Strict Adherence to Asepsis.

Successful surgery is clean surgery. Asepsis is the practice of thoroughness in a wound already sterile. Sepsis is a condition where specific or infective bacteria exist, and where inflammation in some degree always follows. Antisepsis is the destroying of germs or septic conditions present in wounds or tissues by the use of some germicidal agent. It is needless to say that a strict adherence to asepsis must be followed in all forms of local anesthetic injections. I know that it is practically impossible to

render the mucous membrane absolutely sterile by the reason of the delicacy thereof, but we may have an almost, if not quite a sterile field, for the puncture of the needle. We all know that many different forms of micro-organisms are present in the mouth; hence it follows that we must be very careful in considering any and all existing conditions. Any operation, no matter how small or insignificant, should be performed aseptically and with the utmost regard for the principles of asepsis. The puncturing of the mucous membrane during the inserting of the needle prior to making an injection seems of little importance to some practitioners, and while it is true the tissue may tolerate numerous punctures, yet it is inevitable that the practitioner who disregards asepsis will undoubtedly regret such procedure in the future. Nerve blocking injections have considerable advantage over other methods of producing local anesthesia because the needle puncture is made at a point some distance from the field of operation and should always be in healthy tissue. This is true in practically all dental operations. In such cases as operative dentistry the oral cavity is more or less free from pus and the nerve blocking injections may be made by the intraoral method. However, if the oral cavity is in a septic condition, pus being present, and the tissue indicating inflammation the needle should be inserted in the tissue with caution. In some cases it is preferable to block the nerves by the extraoral method, as in cases of fracture of the superior or inferior maxillary, and in impacted third molars coupled with infection producing partial or complete closure of the jaws or any other condition that seems advisable to the operator.

Iodine and Ethyl Alcohol for Sterilizing Gum.

If the intraoral method is used the tissues in the oral cavity should be sprayed with an efficient antiseptic solution. The mucous membrane in the range of the needle puncture should be thoroughly dried. This is best accomplished by using medium-sized pieces of sterile gauze, followed by hot air application. A large area of the tissue should be prepared and care should be taken so as not to permit the part to become moist with saliva. Following this an efficient antiseptic and germicidal solution should be applied. I have tried many different preparations for this purpose and have found none as efficient as equal parts tincture of iodine and ethyl alcohol. This gives a three and one-half per cent. solution of iodine and minimizes the possibility of causing sloughing or cauterizing the surface of the mucous membrane. The tincture of iodine is one of the most effective antiseptics known to surgery. Being introduced into a tissue containing bacteria it will destroy the bacteria and leave the tissue in the best possible con-

Figure 2—Lateral view of wet specimen showing point of incision in order to expose the Gasserian Ganglion and its branches; Internal Maxillary Artery as well as many other important structures located at the base of brain.

dition for repair. The alcohol in the solution is of value in reducing the amount of iodine in the U. S. P. formula and in addition thereto has some germicidal properties. I apply this solution very freely, extending over a surface varying from two to five centimeters in diameter. This antiseptic solution is applied to the particular part with a pledget of cotton wrapped around a small wooden applicator such as those used by nose and throat specialists. These are very convenient for this purpose and are inexpensive. After the antiseptic has been applied to the surface care should be exercised so as not to permit the saliva or any moisture to come in contact with the surface prepared for the puncture.

Iridio-Platinum Needle.

The needle should be of iridio-platinum and after it has been passed through the flame and heated to a red heat, then it should be inserted in the prepared part. Care should be exercised so as not to

Figure 3—Above wet specimen was sectioned through the median line. Note the inner nerve loop which is formed by the naso-palatine and anterior palatine nerves. The anterior palatine nerve is exposed in posterior part of middle meatus. A large clot of blood was removed from the base of the frontal lobes of the brain due to the presence of the tumor which can be seen in the nasal cavity. Circle represents the outline of blood clot.

permit the sterile needle to come in contact with the teeth, tongue, or anything that is not sterile. If the injection is to be made extraorally the skin should be thoroughly cleansed, followed by a seven per cent. solution of iodine.

Preliminary Administrations.

In order to relieve the hypersensitive patient of the feeling of anxiety, and to diminish restlessness and apprehension, I find it advisable in many cases to administer a preliminary agent, such as nitrous oxid and oxygen analgesia, bromural or morphine with hyoscin. In the cases where bromural or nitrous oxid-oxygen analgesia has been employed, it has been upon nervous or neurasthenic patients.

The pharmacology of bromural which is chemically combined with

valarian is that of an agreeable hypnotic and sedative and can be administered without any after effects. Where it is used, one or two tablets should be administered internally thirty minutes before injection.

Nitrous oxid and oxygen analgesia is very efficient. It has been of inestimable value to me in the execution of my work of nerve blocking. I have used it thousands of times in producing that much talked of—"twilight sleep."

Knowledge of the Anatomy Necessary.

It is impossible in this paper to go into the anatomy that is so necessary for the operator to know, I must refer him to any standard textbook for this information. I wish to lay special stress upon the absolute importance of a thorough knowledge of all the anatomical parts, such as osteology, land marks, the nerve branches and their anastomosis, in order to attain results in nerve blocking. It is self-evident that if one is not familiar with the anatomy and the anatomical relations (Fig. 2) before attempting to give nerve blocking injections, he will not secure the desired results, and will only subject his patients to experimental procedures. If the anesthetic is injected in the proper manner, anesthesia will be obtained, and sensitive cavities can be prepared, pulps can be removed, teeth can be extracted or other oral operations be performed, without pain to the patient.

Anatomical Specimens.

The writer is a firm believer in dissected wet anatomical specimens for the reason that they are very instructive. In giving instruction on this subject I have made the statement that one can obtain more practical knowledge in a few hours conscientiously devoted to this study by observing properly prepared wet dissected specimens, than to spend days perusing books on anatomy. It has been my pleasure to prepare a large number of specimens which have proved to be of immeasurable value to me as well as to those taking special instruction in the various phases of local anesthesia.

The specimens used were carefully embalmed and prepared before sectioning at various levels. Then the different nerve trunks and branches, ganglia, arteries, and veins were carefully exposed. Time will not permit me to explain in detail the specimens at this time; they will be shown in the clinic at this meeting and I hope that all may see and profit by them; however, I desire to refer to one of the specimens (Fig. 3). The section was cut through the median line. An incision was made through the skin and muscle extending from the ex-

ternal angular process of the frontal bone, to a point three centimeters above the pterion, then to a point posterior and down just anterior to the antitragus and continuing as far down to a point midway between the sigmoid notch and angle of the mandible. After the above incision was made the flap of skin and muscle was carefully separated from the periosteum over portions of the following bones: Temporal, parietal, sphenoid, superior maxillary, ramus of inferior maxillary and malar. Portions of these bones were trephined away and the inferior portion of the temporal and frontal lobes of the brain removed.

Then the following structures were carefully bared and exposed: Gasserian ganglion on apex of petrous portion of the temporal bone, first, second and third divisions of the fifth cranial nerve. Posterior, middle and anterior superior alveolar nerves; Meckel's ganglion; posterior, middle, anterior and naso-palatine, inferior dental and lingual nerves. The internal maxillary artery and several of its branches are also in plain view. The superficial origin of the fifth cranial nerve, which is at the side of the pons Varoli, is shown passing anteriorly connecting the Gasserian ganglion. All of the fifth cranial nerve and all of its important branches are carefully exposed and traced out in detail to their termination. At the various foramina, such as intraorbital, mental, anterior palatine, posterior palatine, posterior superior alveolar, and inferior dental, crescent-shaped flaps covering the exits of the above nerves were made. It is considered good practice and very instructive for the operator who desires to become efficient in anatomy, depth and direction of the needle to prepare and insert the needle in specimens and then expose the nerve trunk at the point of injection and see whether or not the needle is properly inserted. Pardon my repeating that specimens of this character are intensively instructive and when properly studied the value is unlimited. It is true that many hours are required to properly prepare the specimens, but one is amply repaid by the careful dissection required to properly prepare them.

Tonsillectomy and Adenectomy through the Medium of Nerve Blocking.

After much research in this particular phase of nerve blocking for tonsil and adenoid removal, I am highly gratified by the results so far obtained, and hope within the near future to complete the technique of nerve blocking for this branch of surgery and will later publish the same in detail. This particular phase of nerve blocking has created great interest among the throat specialists, and promises to be of great material assistance to them in the removal of tonsils and adenoids.

Advantages of Nerve Blocking.

The advantages of nerve blocking are numerous but the following will serve as suggestions of some of the most important:

1. **Long Duration.** The duration may be changed by varying the amount of the vaso-constricting agent. The long duration is of great value to the operator for the removal of impacted third molars, reducing fractures, treating the antrum, root amputation, removal of tumors, cavity preparation, removal of pulps and many other similar operations which may come within the observation and practice of the oral surgeon or general practitioner.

2. Large or small areas may be anesthetized, depending upon the nerve branch or branches blocked.

3. Anesthesia is secured of infected or inflamed areas by blocking the nerve branch at a point some distance from the operative field and in the healthy tissue.

4. Nerve blocking injections, when skillfully made, are without pain for the reason that the needle is inserted and the solution injected in the mucous membrane and in loose connective tissue.

5. One or two insertions of the needle will block the operative field, depending, however, upon the nature of the operation and the area to be blocked.

6. Co-operation of the patient. It is well known that this is of material advantage to the operator, because he can operate with ease and complete the operation on the patient with a minimum amount of laceration and without the inspiration of blood and mucus.

Precautions.

1. The anesthetic solution when injected should be near that of the body temperature and must be discharged slowly from the syringe and under very moderate pressure.

2. The syringe and needle should be moved back and forth slightly while discharging the solution into the tissues.

3. Better and quicker results will be obtained by having the bevel of the needle toward the nerve branch and injecting the solution toward such nerve branch or branches and not away from them.

4. The anesthetic solution must be allowed sufficient time to produce anesthesia of the nerve trunk.

5. Use iridio-platinum needles containing a high percentage of iridium and of sufficient diameter and length.

Figure 4—Horizontal section of a specially prepared specimen. The incision extended from the angle of the mouth 1 cm. above and parallel to the occlusal plane of the lower teeth posteriorly through the base of the brain. This section shows the hypodermic syringe and needle in the first position for blocking the inferior dental and lingual nerves. The point of the needle is resting against the periosteum covering the inner oblique line of the Ascending Ramus. Note the needle is parallel with, and one centimeter above the occlusal plane of the lower teeth.

6. Use carefully selected equipment.

7. Keep the needle out of muscle tissue, ligaments and from beneath the periosteum.

8. Always make certain that you have secured complete anesthesia before operating.

9. An isotonic vehicle composed of sterile distilled water and Ringer's constituents plus a known amount of novocain and a vaso-constricting agent should be used.

10. Strict adherence to asepsis must be practiced at all times.

11. Particular attention should be paid to the bad risk patient's pulse

Figure 5—This illustrates the second position of the syringe. It is carried across the median line from its original position to a point outside of the arch on the same side of the injection. The needle point is resting against the Lingual Nerve which is located at the depth of ten millimeters in most cases.

and respiration for any pathological symptoms, both during and after injecting *a quantity* of the solution.

Causes of Post-Operative Pain.

Post-operative pain or complications are caused by one or more of the following factors:

1. By injecting a solution which is not isotonic with the blood.

2. By injecting the solution too rapidly in the tissue.

3. By injecting a solution which is not near the temperature of the body.

4. By injecting a stock solution of some form of local anesthestic which contains various ingredients or one which has undergone deterioration.

Figure 6—The syringe is now carried across the median line in the region of the Cuspid Tooth. The needle point is resting against periosteum near Inferior Dental Foramen forming an acute angle with the surface of Ramus. Depth in most individuals is two centimeters.

5. By using a solution which is not sterile.

6. From employing a syringe or needle which is not sterile.

7. From inserting the needle in muscle tissue, ligaments, or beneath the periosteum or from injecting the solution in the above named tissues.

8. In case post-operative pain is present following the operation it may not be due to any of the above-named factors, but may be caused from the operation itself. If the correct technique is followed, and the injecting solution consists of the proper ingredients and is properly prepared and injected, little or no pain will follow the operation.

Mandibular Anesthesia.
Blocking the Inferior Dental and Lingual Nerves.
(Intra-Oral Method.)

Insert the needle through the mucous membrane, striking the inner oblique line after the external oblique line has been carefully located with

Figure 7—Correct position of syringe while blocking the Inferior Dental Nerve. One centimeter of the needle, which is gold plated, is exposed. The same movements of the syringe are made on patient while blocking the Inferior Dental and Lingual Nerves as shown in the three previous illustrations.

the index finger. Have the distal end of the index finger resting in the *trigonum retromolare* with the dorsal surface of the finger toward the median line (Fig. 4). Retract the mucous membrane beneath the finger in order to give ample room for the needle to pass by end of finger nail through the mucous membrane striking the inner oblique line. Have the barrel of the syringe resting over the two bicuspids on the opposite side. Be careful to keep the needle a distance of 10 millimeters above the occlusal plane of the lower teeth. This is best done by inserting the needle into the mucous membrane at the middle of the finger nail (provided your index finger is 2 centimeters in width). After the internal oblique line has been reached with the point of the needle, bring the syringe across the median line on the outside of the arch on the same side of the injection. Be careful not to allow the point of the needle to go

Figure 8—Horizontal section of a wet anatomical specimen showing exposed Mental Nerve. Needle is in contact with periosteum only at Foramen.

beneath the periosteum (Fig. 5). The approximate distance from the surface of the mucous membrane to the periosteum over the inner oblique line is 5 millimeters. When the syringe is on the outside of arch on same side of injection, insert needle posteriorly about 5 millimeters and inject one-half c.c. in order to anesthetize the lingual nerve. After this has been accomplished, bring the syringe back across the median line to its original position, or nearly so, depending upon the divergence of the two rami. Now insert the needle 10 more millimeters in order to reach the inferior dental nerve. If the syringe has been held in the proper position the point of the needle will strike the periosteum at an acute angle to the surface in the region of the inferior dental foramen, when at a depth of 20 millimeters (Fig. 6). These measurements are approximate.

Inject 1½ to 2 c.c. for the inferior dental nerve. It is necessary for best results to work the syringe back and forth slightly at the time the solution is being discharged from the needle in order to assist the tissues

Figure 9—This illustration shows the correct position of hands and syringe while blocking the Mental and Incisive Branches of the Inferior Dental Nerve. The needle is directed downward, forward, and inward to a depth of one centimeter at which point the needle should enter the Mental Foramen.

in absorbing the solution and not to cause too rapid distension of the soft parts.

Amount of solution used for inferior dental and lingual nerves in the average case is 2½ c.c. The time to wait for the anesthetic to take effect will vary from ten to twenty minutes, depending a great deal upon the skill of the operator and the percentage of the solution used. The needle used for this injection is 30 millimeters long and 22 gauge. If the injection has been made properly you will find you will have complete anesthesia of the three lower molars and second bicuspids, in most cases anesthesia of the first bicuspid and in some few cases the cuspid. This depends upon how rich an anastomosis there is between the inferior dental and lingual nerves on the injected side with their fellow nerves on the opposite side (Fig.7).

Figure 10—This photograph shows the needle point resting in the Left Incisive Fossa for blocking the Left Incisive Nerve. Needle enters tissue between and below roots of Central Incisors in the median line. If opposite side is to be blocked retract needle and force into right fossa without taking needle out of tissue.

Mental Anesthesia.

The mental foramen is located midway between the lower border and alveolar border of the lower jaw. In most individuals the foramen is located beneath the two bicuspid roots. Stand behind your patient, locate the mental foramen with the index finger by palpation or pressure. Keep this finger over the foramen during the time of injection. Depress the lip with the thumb and insert the needle into the mucous membrane at a point where the cheek blends with the gum tissue, just buccal to the second bicuspid. Direct the needle downward, inward and forward (Fig. 8). Insert same approximately 10 millimeters. Strike the periosteum only at a depth as above described and the point of the needle should be in or near the mental foramen. Do not come in contact with the periosteum except at the foramen. Inject one or one and one-half c.c. of the solution.

Figure 11—The above wet specimen shows the needle in correct position while injecting the solution into the Posterior Superior Alveolar Nerve. A special curved needle is used.

Massage the skin over the area of the foramen, forcing the solution through the foramen, thus anesthetizing the incisive nerve in the inferior dental canal, which is a continuation of the inferior dental nerve. You will secure anesthesia of the two bicuspids and in some cases the cuspid (Fig. 9). This injection is sufficient for cavity preparation or pulp removal. If you extract these teeth it will be necessary to block the lingual nerve on the lingual side. The time required for anesthesia will vary from five to ten minutes if injection has been made properly. The needle used is either the one 30 millimeters in length or a 15 millimeter needle. Both needles are 23 gauge.

Incisive Anesthesia.

This injection is used for blocking the lower incisors. Insert the needle at the median line below the roots of the two incisors at a point where the lip blends with the gum tissue. Direct the needle downward,

Figure 12—Illustration showing the needle in correct position for blocking the second division of Trigeminal Nerve and Meckel's Ganglion and its branches which are located in the Spheno-Maxillary Fossa. (Intra-Oral Method.)

backward and laterally to an approximate depth of 10 millimeters, striking the floor of the incisive fossa. Inject one c.c. Retract the needle without removing it from the tissue and bring the syringe to the opposite side and repeat the technique for the opposite fossa in case the nerve supply for all four incisors is desired to be blocked (Fig. 10). The incisive fossæ have numerous small foraminæ which transmit branches of the incisive nerve, and when the solution is injected at this point anesthesia is secured in most cases in five minutes. The needles for this injection are similar to those used for mental anesthesia. Always remember that it is necessary to block the nerve supply on the lingual side in case you desire to extract or do any kind of operative work which involves the structures on the lingual side.

Tuberosity Anesthesia.

This injection is used for blocking the posterior superior alveolar nerve which supplies the upper second and third molars and a partial

Figure 13—Upper section of wet anatomical specimen showing termination of Infraorbital Nerve and needle in its correct position for blocking this nerve and the Anterior Superior Alveolar Nerve.

supply of the first molar. This nerve also anastomoses with the dental plexus which is also formed by the middle and anterior superior alveolar nerves. The technique for this injection is as follows: Insert the needle at a point near the apex of the disto-buccal root of the upper second molar, directing it upward and backward to a point about 3 or 4 millimeters above the apex of the third molar (Fig. 11). After the needle has been inserted into the tissue to an approximate depth of 10 millimeters, the needle should strike the periosteum over the greatest part of the curvature of the maxillary tuberosity. After you have accomplished this, follow the periosteum as closely as possible and insert the needle 10 more millimeters. The point of the needle should now be resting in the location of the entrance of the posterior superior alveolar nerves into the superior maxillary bone (Fig. 12). (Remember that these measurements will vary slightly in different individuals.) The foraminæ which give entrance to

Figure 14—This illustration shows the correct position of the finger and needle for blocking the Infraorbital Nerve. Tip of index finger rests over the Infraorbital Foramen. The needle is carried along an imaginary line drawn from the pupil of the eye to the apex of the second Bicuspid Tooth.

these nerves are located from 1½ to 2 centimeters above the disto-gingival margin of the upper third molar (or second molar in child). Inject 2 c.c. of the solution. You will obtain anesthesia of the upper second and third molars, and in a very small percentage of cases the first molar. The approximate time to wait for anesthesia is from 3 to 10 minutes. If you are going to remove these teeth block the anterior palatine nerve. The needle used for this injection has a slightly curved hub or shank and is 30 millimeters in length. It is 22 gauge.

Infra-Orbital Anesthesia

Locate the infra-orbital margin with the left index finger. Stand in front of the patient. After the infra-orbital margin has been located, bring the finger downward approximately 10 millimeters and hold same

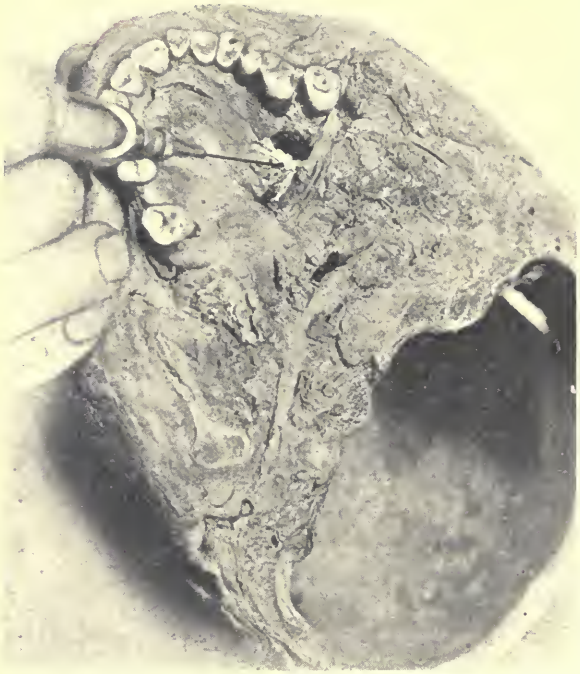

Figure 15—Horizontal section of wet specimen showing exposed Anterior Palatine Nerve, a branch of Meckel's Ganglion. This nerve is located approximately fifteen millimeters from the Lingual Gingival Margin of upper third Molar.

in this area during injection. The infra-orbital foramen is located 10 millimeters below the infra-orbital margin in most cases. Have your patient look directly forward and observe that your index finger is directly beneath the pupil of the patient's eye (Fig. 13). Draw an imaginary line from the pupil of the eye to the apex of the second bicuspid and the line will pass through the infra-orbital foramen. While your index finger is resting over the foramen lift the upper lip with the thumb, thus exposing the tissue in the region of the bicuspid (Fig. 14). Insert the needle into the mucous membrane on the buccal side of the second bicuspid at a point where the cheek blends with the gum tissue. Carry the needle upward, directing it at a point beneath the index finger. Be very careful to have the *needle parallel with the second bicuspid* (provided patient has normal occlusion), as it will give you an excellent guide in locating the infra-orbital nerve. *Do not* come in contact with

Figure 16—This illustrates the position of the syringe and needle while blocking the Anterior Palatine Nerve. The needle enters the tissue at right angle to the surface.

the periosteum except at the time the point of the needle strikes the region in or near the foramen. Inject 2 c.c. of the solution. After a few minims of the solution have been injected you can readily detect the presence of the point of the needle and it will assist you in determining whether or not you have the needle in the right location. After the solution as been injected, gently massage the skin over the injected area, thus forcing the solution into the infra-orbital canal. This will anesthetize the anterior superior alveolar nerve, which is given off from the maxillary division of the fifth nerve in the infra-orbital canal approximately 5 millimeters posterior to the infra-orbital foramen. The success of this injection depends upon the solution reaching this nerve (anterior superior alveolar). The anterior superior alveolar nerve supplies the upper central, lateral and cuspid teeth, also anastomosing with the dental plexus located over the bicuspids and with its fellow on the opposite side. Therfore, if you require anesthesia of the central, lateral and cuspid teeth

Figure 17—This section shows the needle inserted into the Nasal Palatine Nerve as it makes its exit from the Anterior Palatine Foramen.

Blocking the Long Buccal Nerve.

The long buccal nerve is a branch of the third division of the fifth nerve. It varies in length in different individuals. I have found that at least 25 per cent. of the cases do not require blocking of this nerve for extraction of the lower second and third molars. In at least 75 per cent. of the cases this nerve sends branches to the buccal area of these two teeth. Two methods can be used for blocking this nerve. First, nerve-blocking anesthesia, which is accomplished by inserting the needle distal to the opening of Stensen's duct. Inject about 15 minims of the solution. The second method used is that of infiltration. Insert the needle into the mucous membrane near the apex of the mesial root of the lower second molar, forcing it posteriorly along the periosteum until it reaches a point distal to the third molar. Inject the solution continuously, using about 1 c.c. This is easily accomplished with the patient's mouth closed.

Anesthesia is produced in from one to three minutes, the needle used being the same as for infra-orbital anesthesia.

Naso-Palatine Anesthesia.

The naso-palatine nerve, which is a branch of Meckel's ganglion, enters the palate through the anterior palatine foramen. It passes laterally along the ends of the roots of the central, lateral and cuspid teeth, anastomosing with anterior palatine nerve on the lingual surface of the cuspid. Insert the needle into the tissue just posterior to the most posterior papilla. Direct the needle upward and backward (Fig. 17). Insert same from 7 to 10 millimeters and inject 7 or 8 minims of the solution. The time for anesthesia is from two to three minutes. Two needles are used for this injection. One is similar to the one used for infra-orbital anesthesia, and the other is a fine, sharp one used to make initial injection.

Infiltration Anesthesia.

Infiltration anesthesia is brought about by saturating the tissues in a circumscribed area with an anesthetic solution. It is called *Terminal Anesthesia* because the anesthetic acts upon the terminal branches of the sensory nerves. It is called *Regional Anesthesia* because the fluid injected affects a particular part of the sensory nerve in its course. By the use of a suitable local anesthetic the nerve elements lying in the infiltrated tissue become functionless. Infiltration anesthesia is a term used to indicate a form of local anesthesia in which the tissues are not only injected, but are distended decidedly with a fluid anesthetic indifferent in nature. If the injecting solution contains a large quantity of the anesthetic, the anesthesia is diffused for some distance beyond the point of injection, and this secondary anesthesia, or, in other words, the anesthesia which has been produced in the tissue surrounding the area infiltrated, is known as *Indirect Infiltration Anesthesia.* It will be found that the action of the anesthetic is always due to its immediate contact with the sensory nerve element, be it in the terminal nerve ending or in a nerve branch. It is self-evident that profound anesthesia can be secured much more quickly when the terminal method is employed, in comparison to the nerve blocking method; that is, injecting the solution in or near the nerve trunk, thereby requiring a longer period of time for absorption and diffusion of the anesthetic substance through the nerve trunk, which is a much larger structure than the terminal or peripheral branches. The area of anesthetized tissue depends upon the quantity of solution employed When this method is used we depend upon the diffusion of the anesthetic solution through the minute openings of the alveolar process to anesthetize the nerves supplying the teeth.

Figure 18—This photograph illustrates the needle in position for anesthetizing the two superior bicuspid teeth by the Terminal Method. Needle punctures tissue over apex of cuspid and is forced posteriorly to point over apex of mesio-buccal root of first Molar.

We must consider the histology of the alveolar process in different locations of the superior and inferior maxillæ. It is found that the structure of the alveolar process varies in different regions. In some regions it is very porous, while in others it is more or less dense in structure. Therefore, it is almost impossible to obtain good results from infiltration anesthesia in areas where the process is dense in structure.

The infiltration method can be employed with very good success for all teeth in the upper jaw. The dense alveolar plate which covers the cuspid, bicuspids and molars in the lower jaw inhibits the absorption of the solution, and the method is, therefore, contraindicated in most instances in this region.

Blocking the Upper Two Bicuspids.

Infiltration anesthesia for these teeth in most cases is the method of choice for the dental practitioner. Insert the needle over the apex of

the cuspid tooth, forcing the point down to the periosteum. Carry the needle posteriorly along the ends of the roots of the bicuspids to a point near the mesio-buccal root of the upper first molar. Be careful to keep the needle parallel with the occlusal plane of these teeth (Fig. 18). Inject the solution continuously from the time the needle enters the tissue until it has been inserted to the proper depth. Use 2 c.c. of the solution for this injection. The needle used is the same as for the infra-orbital anesthesia. If you are going to block only one bicuspid, then use the 15-millimeter needle. Massage the gum tissue over the injected area. If you are going to remove these teeth make a lingual injection as follows: Hold the syringe across the mouth; allow the barrel to rest on the lower teeth on the opposite side. Pierce the gum tissue midway between the linguo-gingival margin and the ends of the roots of the two bicuspids. Force the needle downward, forming an acute angle with the surface of the gum tissue until it strikes the periosteum, then bring the needle parallel with the surface of the inner plate of the alveolar process and force the needle upward in the region of the anterior palatine nerve. The approximate depth of the needle is 15 millimeters. Inject 7 or 8 minims of the solution. The time for anesthesia is from two to five minutes. The needle used is the same as for infra-orbital injection, or the needle for infiltration.

The infiltration method is not always the method of choice. The nerve blocking method does not require numerous punctures in the mucous membrane, as does the infiltration method in case a number of teeth are to be anesthetized, and enables us to anesthetize a larger area with a single injection, and the nerve trunk which is surrounded by healthy tissue is blocked at a distant point from the probably infected field of operation.

Extra-Oral Nerve Blocking for Oral Surgery.

This method is to be employed when the intraoral method is contraindicated. In nearly all operative cases the nerve branches can be blocked by the intraoral method; however, the intraoral method is not the method of choice under certain prevailing conditions. The extraoral method should be employed in those cases where pus or a great amount of inflammation is present within the oral cavity, or in cases of impacted third molar of the third degree type, accompanied by pus, inflammation and trismus. The extraoral method is of great advantage in cases of fracture of either jaw which is accompanied by tenderness and swelling; also in antrum operations, removal of tumors, as well as any other pathological condition in which the operator deems the intraoral method contraindicated. Braun was one of the first to present extraoral anesthesia; however, it has

Figure 19—The above illustrates the landmarks which are used by the writer outlining the areas in order to start the needle correctly for blocking the second and third divisions of the Trigeminal Nerve by the Extra-Oral Method. The white spot in the center of the triangle indicates location for starting needle for Second Division and the spot within half circle indicates area of puncture for Third Division.

not been employed to any extent up to the present time. It has been the writer's experience to carry out considerable research work on cadavers, and he has inserted the various needles used for extraoral injections into anatomical specimens, as well as making a large number of injections on patients in the clinic. I trust the simplified technique presented here for extraoral as well as intraoral methods will prove of value in oral surgery and to general practitioners. It has been my aim in all technique worked out to make it simple and practical, combining efficiency with ease in executing any injection.

Extra-Oral Technique.

Time will not permit a thorough detail of this phase of local anesthesia, and I will give only a very brief outline. The skin through which

Figure 20—Photograph showing the needle in correct position for blocking the third division of Trigeminal Nerve at a point anterior to its exit through Foramen Ovale. (Extra-Oral Method.)

the needle is to be inserted must be surgically prepared. The part must be shaved and thoroughly cleansed with soap and water, then followed with 1/2000 sol. bichloride and then tincture of iodine is applied. I make an initial injection into the skin with a very fine sharp needle in order to eliminate the pain which would be caused by the regular needle for the deep injection as it enters the skin.

Anesthesia of Inferior Maxilliary Division of the Fifth Nerve.

After the initial injection has been made with small, sharp needle, the long needle is employed (Fig. 19). The following landmarks are carefully followed. Draw a line (before the skin is prepared) at the lower margin and parallel to zygomatic arch, directly above the sigmoid notch of the mandible. Connect the two ends of this line by following the lower part of the sigmoid notch. This will give a half circle and indicate the location of the sigmoid space. Pierce the skin with

Figure 21—This illustration shows the Gasserian Ganglion and its branches; also the needle point resting in the third division of Trigeminal Nerve. (Extra-Oral Method.)

the needle in the center of this outline. Direct the needle inward, slightly backward and slightly upward to a depth of 40 millimeters in most cases, and the point of the needle should be in or near the *foramen ovale* which transmits the third division of the fifth nerve. Inject 3 c.c. of the solution (Figs. 20, 21 and 22).

Anesthesia will be secured in most cases within twenty minutes in the entire lower jaw, lower lip, part of cheek, etc., and will remain in most cases from one to two hours. The needle used for the injection is 60 millimeters long.

Anesthesia of the Second Division of the Fifth Nerve.

Blocking the superior maxillary division of the fifth nerve in the spheno-maxillary fossa is easily accomplished. Locate the anterior surface of the ascending ramus, also the anterior part of the coronoid process

Figure 22—Illustrating the position and direction of the syringe and needle in blocking the third division of the Trigeminal anterior to the Foramen Ovale. (Extra-Oral Method.)

of mandible. Next locate the lower margin of the zygomatic arch in this region. Now draw a line along the lower margin and parallel to the zygomatic arch. Next draw a line parallel on anterior side of coronoid process of mandible. Make each line about 20 m.m. in length. A right angle is now formed and connect these two right angle lines with another line, thus making a triangle. After the primary injection has been made and the skin treated aseptically, pierce the skin in the center of the triangle with the long needle. Direct the needle backward, inward and upward, and when same has entered the tissue to a depth of 25 to 30 millimeters, in most cases the point of the needle should strike the posterior lateral surface of the tuberosity at a point 2 c.m. above the disto-gingival margin of the upper third molar (second molar in child). At this location are located the posterior superior alveolar foraminæ, giving entrance to the posterior superior alveolar nerves (Fig. 23). The point of the needle should strike the periosteum covering the tuberosity,

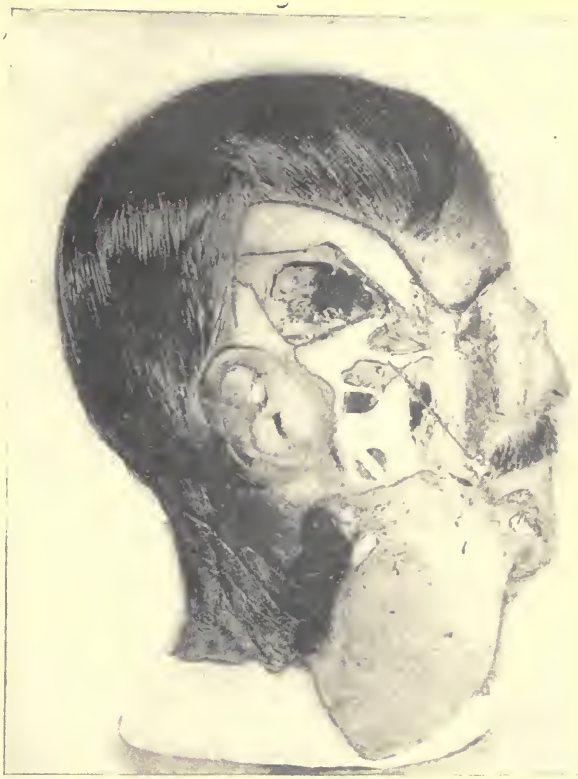

Figure 23—This illustration shows the point of the needle inserted into the second division to the Trigeminal Nerve anterior to its exit from the Foramen Rotundum. Note the position of the needle for making this nerve blocking injection. (Extra-Oral Method.) Also note Gasserian Ganglion and its branches.

as it is an excellent guide indicating that the needle is going in the right direction. Force the needle past the tuberosity 2 more centimeters and the point should then strike the greater wing of the sphenoid bone within the spheno-maxillary fossa. The point of the needle is now located about 15 millimeters anterior to the *foramen rotundum* which gives exit to the second division of the fifth nerve. Inject slowly 2 c.c. Entire depth of needle in most cases is 50 millimeters, needle used is 70 millimeters long. Anesthesia is secured within fifteen minutes in most cases.

Structure anesthetized: All structures supplied by the second division of the fifth nerve, such as the superior maxillary bone and teeth, walls of antrum, part of cheek, gum tissue, periosteum, half of palate, etc. Anesthesia persists from one to two hours.

Figure 24—Anterior view of anatomical specimen showing exposed Infraorbital Nerve. Note the needle which is inserted into the Infraorbital Foramen for blocking this nerve and the Anterior Superior Alveolar Nerve. (Extra-Oral Method.)

Anesthesia of Infraorbital and Anterior Superior Alveolar Nerves.

Treat skin aseptically as described. Locate the infra-orbital foramen with tip of index finger. An imaginary line is drawn from the pupil of eye to apex of second bicuspid tooth. Use fine needle as above directed. Next use the regular needle and pierce skin 5 millimeters below the opening of the infra-orbital foramen, force needle inward and upward approximately 2 c.m. Needle will enter canal. Inject slowly 2 c.c. Needle is 30 millimeters long and 23 gauge. Anesthesia is secured in less than five minutes in the following structures: Central, lateral and cuspid. providing anastomosis is broken; side of nose, upper lip, labial gum tissue and periosteum, alveolar process (Fig. 24).

I am safe in making this statement, that there has been no discovery or method used in the practice of dentistry for the purpose of enabling

us to do better work resulting in more satisfied and grateful patients than that accomplished through the medium of the relief of pain. The progress of dental science has been wonderful during the last ten years, and it is gratifying, I know, to every member of our profession to see what has been done in research work in all its phases, and to my mind the relief of pain is appreciated most of all by the patient; the proof of this statement is manifested by the enthusiasm of the patients who have been operated upon and who go on their way rejoicing, praising the dentist who rendered them such service. The dentist who familiarizes himself and becomes proficient in the relief of pain and who gives his patients the benefit of his knowledge is the one whose services will be a pleasure—and his patients will speak more words of praise and commendation for him; he will be enabled to render his patients a higher professional service, and will not be handicapped in his operations.

The immediate field of operation that the dentist is called upon to treat is supplied by the fifth pair of cranial nerves; perhaps the most sensitive of the human body; especially is this true regarding pain, which is the only sensation conveyed by the dental pulp.

We are living in a time when the public demands services with the least amount of pain. Therefore, it is the duty of every dentist to study and apply that which the sciences of medicine and chemistry offer. The day of the practitioner who contends that a light touch and a sharp bur is all that is necessary in modern practice is rapidly passing, and all antiquated methods and ideas will be in the archives of discarded things, and he will have to grasp the tool of efficiency and travel with the modern trend. It is self-evident that an operator can render better service when the patient is free from pain, as he can better remove the decayed dentin and prepare cavities scientifically.

When service can be successfully and painlessly rendered without endangering the health of the patient, it is always advisable; for any agent that has for its object the relief of pain is worthy of our earnest consideration and study.

In conclusion, I wish to state there can be no loftier, more practical manifestation of love for suffering humanity than is exemplified in the benignant effort to assuage the pain to which mankind is heir; nor can there be any devotion more privileged and inspiring than that which eliminates the shock that is bound to accompany a very high percentage of those operations where no pain relieving agent is employed, but illumines the darkness of mental and physical distress and creates anew the image of Divine perfection.

The constant aim of the conscientious practitioner of medicine and

dentistry should be to lend a helping hand to suffering humanity and to put forth every effort in the combating of disease and pain, not from a remunerative, but from the humanitarian standpoint. It is this uplifting and the consecrated zeal, akin to veneration for the science, which should be dear to him and which has given to the world the masters of the profession. It is only a question of time until the fear of the dental chair will be forgotten, and the public will acclaim with the greatest pride and gratitude, "Another great benefactor—the dentist."

Medical Superstitions.

By Garrett Newkirk, M.D., D.D.S., Pasadena, Cal.

What is a superstition? The Standard Dictionary defines several forms. First, distinctly religious superstitions, so-called, which consist in the veneration of objects not deserving of veneration—attaching undue importance to ceremonies, etc., etc.

Second, a variable definition depending on the point of view—"Belief in some system which seems unreasonable—except to the believer himself." And third, the following, which applies more closely perhaps to the question I have in mind.

"Any popular notion attributing occult influence of some kind to trivial things, as belief in omens, charms and signs, as, for example, the superstition about spilling salt." Of course, the enumeration of each superstition would be an endless task, for there is a new one born, not perhaps with every fool, each minute, but a number without doubt get started with every circling year. We have been compelled to have impressed upon our memories a few, especially of the things that bring "bad luck," such as crossing a funeral procession, or counting the carriages thereof as a preliminary condition of one's own speedy death; breaking a mirror, killing a cat (one of the best things possible, in my opinion), the Friday hallucination, the thirteen hoodoo, and the relation of one's scapula to each new moon.

The Standard Dictionary's phrasing is happy—worthy of repetition. A "*notion*—attributing occult influence of some kind to trivial things"—not *causes,* mind, but things. To reason there can be no thought more clear than this: Absolutely no effect can be produced at any time or where without an adequate cause. This is the first principle of physics or philosophy. Without acknowledgement of this we cannot think intelligently. To believe otherwise is in itself a confession of ignorance or imbecility. No effect without a sufficient cause—this must be true. But it does not follow that we shall always know the cause or antecedents of what we see? We soon reach the limits of positive knowledge. The realms of mystery are all about us—and within us.

Now, a common superstition among people, and a frequent cause of

grief, is that the doctor does know; that he ought to know and be able to explain that which is yet entirely beyond his knowledge, and therefore unexplainable. Out of this demand there comes temptation to the doctor to appear wiser than he is and to attempt explanations, plausible, perhaps, but inherently weak. And there is often such desire on his part to find the explanation that he himself constructs a theory and is tempted to accept coincidence instead of fact or demonstration in support thereof.

The basis of a common superstition is: First, lack of faith in established principles; out of this comes belief in luck instead of law. Second, with the desire to explain something, or to accomplish something within the realms of the unknown, appearances are permitted to deceive—facts are misinterpreted, misapplied, in violence of reason.

As an illustration of the origin and growth of a superstition, take the following, a very simple case:

A boy hears that seeing the new moon over one's shoulder, right or left, brings good or ill luck. This he remembers. In a few days he sees it over the left. The fact is on his mind. During the month something is sure to happen that he considers bad—he cuts his finger, gets a bruise, or loses his knife. "There!" he says, "I saw the moon so and so. It's bad luck—this proves it." Next time he sees the crescent otherwise, over the right. He remembers, and during the month whatever happens to please is associated in his mind with the idea of *good luck.* Ere long it has become his regular habit to look for and expect these supposed relationships. And the remarkable thing is, that after he has corrected his philosophy by exercise of reason, he can never get the false idea out of his mind entirely. It will intrude upon his consciousness when he sees the new moon ever after.

The origin and growth of a medical superstition would not be very different. Such a thing would not occur, of course, with a present-day doctor (?), but years ago the history might have been about as follows:

The doctor had heard that something or other was "good for" the "treatment" of some form of ailment. He remembers, and when a case presents he tries the drug or mixture, whatever it may be. The patient improves and after a time gets well. This occurs twice, thrice, any number of times. He keeps account and makes a "report of cases" for publication. He has seen the moon over his right shoulder this time. Then he or some one has a "run" of cases that do not do well with the administration of this "remedy," and it is discredited. It is now a left-hand moon. Then it is like to be an old moon, discarded—or, like a meteor that has flashed for a moment in the sky and lies buried in the earth to be seen no more, unless perchance discovered by the specialist and placed in some museum.

A superstition is a cipher disannexed from any figure of fact. It seems to be something, but is not. All sorts of things may be tied to it with imaginary cords, but there is absolutely nothing in it.

The Esoteric Cause of Health and Disease.

Now let us ask: What are the essential curative forces of the human body in relation to its usual ills? They are the same, are they not, as exists in the animal creation generally? Of course, human beings have added many things by complicated modes of life and unwise habits peculiar to the species. But the principles of life are yet the same. And they appear to be simple.

There is in each body a force, a central discriminating agency, that is beyond our comprehension. It cannot be discovered nor analyzed by any thought process. We have simply to recognize its existence as a base of theory and practice. In relation to disease the ancient fathers of medicine expressed it in the term, *"Vis Medicatrix Naturæ."*—the power of Nature to cure.

Animals in their natural state, free from man's dominion, almost never, I believe, die from disease. They die of violence or lack of food, because of injury or old age. What do they live by? What do we live by? How do they or we resist or overcome the forces all about us or within us that would cause our death? What can this mysterious force, this balance of power we call life, make use of to sustain health, repair injuries and restore right function?

First of all it can use those substances that have a definite relation to nutrition; that which may be in itself a food or assist in the digestion or assimilation of a food. It must be an element, or necessary adjunct to an element, that builds the intricate yet simple structure of tissues. This life force must have material, and men have learned by centuries of experience where these materials are to be found. They have learned that out of the soil, by a Providential fitness, certain things grow for the sustenance of animal life. They have learned that all, except those distinctively carnivorous, find in these everything they need; and further that the eaters of animal food obtain the same elements only a step removed from the vegetable world. Therefore it follows without question that the one who assumes in particular the treatment of human ills should know all there is to be known, or at least as much as may be for him possible about foods, their nature, preparation and administration. They should be masters of the subject of nutrition as related to people of different employment, environment, habit, heredity, climate, and at various periods of life. This knowledge, duly applied in practice, constitutes the physician an assistant builder to the Life Force, who only

does the work and can use none other material than what is furnished. This is legitimate, common sense materia medica. If, without due attention to this field of study and practice, the doctor neglects it, and instead thereof gives his mind to the administration of drugs in combinations innumerable, watching for and guessing at their supposed effects, he is practicing not science, but superstition. In accordance with our definition, he is "attributing occult (or mysterious) influence" to a thing that bears no relation to the cause. If he does not contribute an element to the stock of life force, but instead injects something at a venture that has no food relation, he is an interference rather than a builder. Suppose that he were called to help a tree suffering from defective soil or drought, and should order it peppered with lead once in four hours from an ordinary shotgun. He might, of course, kill a few scale, along with greater injury. And then if by a fortunate rain or supply of nutriment the tree should recover and live, and he should claim credit therefor with confirmation of his theory, he would furnish certainly a good example of superstition.

And this is very much as the ordinary drug prescription of fifty to a hundred years ago looks to the physician of to-day. How will the practice of to-day look to those on earth a hundred years from now?

The number of drugs and drug combinations administered to humanity within your remembrance and mine would make an endless count. Look through the American pharmacopia; go through the files of medical journals, and of all the thousands experimented with, recommended, how many hold place in use or even memory to-day? What do they all represent more than superstition?

Alcohol.

Most prominent perhaps of all medical superstitions is that relating to alcohol. Of course, it was first of all a popular superstition; but it was accepted nevertheless by medical authorities as a necessary belief. The agent itself was supposed to be indispensable and necessary. There was never a time when the belief had any base in common sense or sound reason. From the days of Jehonadab, the son of Rechab, and before, there have been some who were utterly skeptical of its virtues. Never could it be shown to have a relation to nutrition, blood support or purification, but ever the reverse. Yet, because it had certain deceptive effects that many found pleasurable and wished therefore to believe useful, the doctors based their practice largely upon its employment.

It would seem an easy question for anyone to ask that if alcohol were necessary to the welfare of human bodies, why should not provision

have been made for its supply to all the animals we call "lower"? They have it not, and whenever it has been forced upon them its effects have been evil. No farmer would think of giving alcohol to his horses to increase their strength, or to his cows for improvement of milk.

Now, as alcohol had the property of dissolving and holding in solution a larger number of other agents superstitiously believed or imagined to have occult virtue, it became the base of innumerable tinctures and extracts, each of which took a turn at the inside surface of human beings, and tested vital resistance.

Look at the array of those now discarded along with those that sooner or later will be. What do they represent? Nothing but superstition—"attributing occult influence" of some kind to "trivial things"—adding to the definition, however, that sometimes the effects were anything but trivial, involving as they did the purchase of cemetery lots and grave-stones.

The Profession of Medicine.

I am myself, as some of you know, a graduate of medicine, with some years of successful practice. I am proud of my Alma Mater, "Old Rush." I have the greatest respect for the profession that calls itself "Regular." It has made wonderful progress in scientific knowledge, especially in all things surgical. But I am compelled to admit that the profession of medicine has stood like a wall against reform as involved in the abolition of alcoholic beverages, because it was claimed that alcohol did have, must have in some mysterious way beneficial effects, medicinally if not physiologically. Not a year has passed within my remembrance that some high authority in medicine has not claimed for alcohol that it is really a food.

It is within three years, I think, that an elaborate argument was made by an eminent physician, fortified by numerous hospital statistics, all published in the journal of the American Medical Association, showing conclusively to the mind of the author of the paper the blessed effects of alcohol.

And now comes a simple mechanical contrivance for the measurement of muscular power, nervous control, co-ordination, ability to think, quickness to perceive, acuteness of every sense—in a word, everything relating to human efficiency. And it is demonstrated beyond a doubt that alcohol introduced into animal blood, in any amount, under any circumstances, adds nothing, but on the contrary subtracts from efficiency of every sort.

What common sense has believed all along is now accepted by those in authority perforce. And we have the marvelous example of a super-

stition throttled in one nation at least by law. In the United States we find that the production of one form of alcoholic liquor has fallen off in one year; in Kentucky, 66 per cent.; in Pennsylvania, 33 per cent.; in Maryland, 40 per cent.—(*Collier's,* June 12.)

Medical men have learned, or they are learning and will learn, that their alcohol superstition has been responsible in part for the large consumption, dire effects and waste of so-called "Patent Medicines," and everything disguising "booze" under the name of "bitters" or other deceptive cognomen.

Superstitions of To-day.

As already intimated, it is easy enough to label some of the superstitions of a hundred years ago, and to imagine that we are now quite enlightened and free. But are we? Our vision is so centered on the present, we see the past but dimly and the future not at all. But we are only a little less credulous perhaps than our forbears. Are we not likely at times to swap a superstition of the past for one of the future? We are still inclined to explore the realms of mystery for all kinds of specifics. A few we have found for certain things; more we may find, but they must ever have relation to definite causes, not to fancy. There is this danger with study along these multitudinous paths of theory and experiment, that simple, old-fashioned truths be forgotten.

Some months ago I was asked by a lady, a visitor in town, for reference to a physician. She had some local infection of the neck or scalp that threatened boils. I sent her to one of our best doctors, known and respected from ocean to ocean. Meeting her a week later I learned that her condition had not much improved, and she was becoming more anxious about it. I asked what the doctor had done for her. "Oh, he didn't do anything except inject a vaccine into my arm."

"Did he not prescribe a saline cathartic, or a hot bath? Did he not make a suggestion relating to your diet or exercise?"

"No," she replied, "he made no inquiry or suggestion; he simply looked at the swelling and injected the vaccine; and I have been back twice for repetition of the same thing." I understood some weeks later that the swelling had quite disappeared, and that the doctor's bill for each treatment was rendered and paid.

This management of a case may be in strict accord with modern, scientific procedure, but to me it savors of superstition. If I were the patient I would want some attention paid to such old-fashioned organs as the stomach, bowels, kidneys and skin.

Too often, I fear, the attitude of the doctor is practically like that of the patent-medicine concern that sent out a circular recently reading

thus: "Send us your name and address, and get by return mail a box of our wonderful cure—to try at *Our Risk.*"

My friends, suppose that you were to go into a drug store that was opened we will say forty years ago—possibly several times enlarged. There are, of course, in that store a thousand things not on the line of drugs that a physician would prescribe, many fanciful, some useful, all supposed to be in fashion. But the drugs—what of them? On the shelves, rows upon rows of tinctures and fluid extracts, and mixtures aside from those proprietary; drawers filled with boxes and jars. For most of these there is little demand. Few of them are prescribed by the physician. In the years gone by many were thrown away. Some are kept on the mere possibility that they may be called for by somebody.

What are they all worth to humanity? Practically nothing; most of them have been a curse. Yet every one at some time had a vogue. They represent millions of experiments, watching for "effects," records, statistics of "results," etc. And the experiments were not all at the doctors' risk. As I remember, it was Dr. Oliver Wendel Holmes who said the world would be better off if the whole mass could be swept into the sea, without possibility of reproduction. If he did not say it, I say it.

The drug superstition of the "Regular" profession has been responsible, I have no doubt, for the uprise of all sorts of isms and pathies. Homeopathy was a protest against excessive and unpardonable dosage. *"Similia Similibus Curantur,"* and the theory of attenuation, made possible a pratice with bits of sugar substituted for nasty drugs. And people got well, of course, partly because they believed they would, and partly, no doubt, because of better attention to hygienic measures that the doctor and patient had time for.

There is nothing more absurd I suppose than the homeopathic theorem, "Like cures like," but it served as a peg to hang something on. As to the attenuation theory it is interesting to note that nowadays the "Regular" is administering calomel in doses of 1/30 or 1/60 of a grain, of which he used to give three hundred times as much. Is it not funny? Of course, this diminution is a good thing; so near to nothing is almost as well. It never occurred to Methuselah that mercury had a place in his economy. His was a superstitious age, no doubt, but he escaped some.

Water as a Remedial Agent.

It will be admitted, I think without question, that water has a place of some importance in the animal organism and as a therapeutic agent. Nevertheless, observation leads me to doubt that one in a hundred of medical men have learned to use it as they might and should in every-day practice. Water hot, water cold, lukewarm, applied

externally, topically. Its possibilities are wonderful—almost limitless. Because of its neglect some fifty years ago, by doctors who were chasing drug phantoms, there arose a school of hydropathists. They treated disease without drugs, by water power, including therewith modifications of temperature.

These practitioners were ridiculed, of course, but they worked the idea for all there was in it, and did a lot of good. In ordinary cases, without surgical complications, they succeeded admirably in allowing sick people to get on their feet.

Closely allied to these were the Thompsonians (followers of Thompson), who rebelled against minerals in toto, especially mercury. In those days the title of honor consisted not in the removal of an appendix vermiformis, but in the number of times one had been salivated. The mercurial superstition has been a long time dying. The tail is still wriggling at the rate of one six-hundredth.

Osteopathy.

Again, the regular profession hath been greatly exercised and grieved by the rise of "osteopathy" and kindred cults, the chiropractic, etc., etc.

Nobody to blame but the regulars themselves. The pharmaceutical inventors were busy every day with new combinations. Forty men, more or less, were lying awake nights contriving formulæ and bringing out new names beginning with "ich," or "zy" or "thy," ending with "ol" or "mol" or "gol," etc., etc.

Each one, widely advertised, the gullible doctors were bound to try, and so they neglected altogether the important matter of *manipulative therapeutics;* also systematic exercise. It has little or no place in the course of instruction of medical schools. It is unappreciated and neglected as a rule by the "regular" practitioner. Into this good ground left vacant, osteopathy sprang up and multiplied. Of course, it has claimed what did not belong to it—Isms always do. But its devotees were honest, as a rule, and they have done more good, I believe, than harm.

The philosophy of the matter appears to me, briefly stated, as follows:

The normal child if given a fair chance exercises his body as a whole—no part of his organism, nervous, muscular ligamentous, arterial, is left unused. By this he maintains the strength he has acquired. The law follows through life. But his exercise habits do not follow; in later life exercise is neglected, or is only partial, unsymmetrical. The unused tissues weaken, dwindle, degenerate, their nerves are anemic, irritable. They come to resist use, like those ligaments about a dislocated joint or fracture.

These individuals are told and believe they have neuritis, or rheumatism. They may have these possibly as secondary conditions, but their real trouble comes of disuse. The exercise they really need is painful, and they avoid it. They do not know that they should take it. The doctor when consulted does not see that the remedy needed is calisthenics, exercise. He prescribes instead probably rest, the very opposite. And he gives drugs for a theoretical control of blood conditions. Or he charges the body of the patient with electric currents, hoping to excite a healthy reaction in the parts chiefly involved. Little if any good results. The cause is not reached. Now comes the osteopath or the Swedish movement expert, and with his pushing and pulling and twisting and stretching, rotation and extension, undertakes to give to the body of that patient the exercise in general he should have taken for himself, regularly through years past. This may be along with hot baths and dietetic treatment, both helpful. New action is set up in relation to the parts, their blood supply and nutrition in particular. The patient feels better, and if he follows up his own case with due exercise gets fairly well again; and the man of one idea, that happened to be a practical idea, is called a "Quack."

The superstition of drugs—to inject something into the man's body that does not belong there, having no relation to life force; the false theory of a "rest" cure where exercise was needed; these things have made possible and inevitable a "school" based upon manipulation, with many theories otherwise vague, fantastic and absurd.

Every medical school should teach calisthenics thoroughly—the theory and practice of use, exercise, general and special, as a part of its therapeutics. This woulld be of greater value to the prospective doctor and his patients than the most intimate acquaintance with cholagogues or anthelmintics.

Dyspepsia Cured with Buttermilk.

As to relative values of physiological medicine and other kinds, a simple illustration is worth more perhaps than a whole book of sermons.

A friend of my family, living in Chicago, after years of suffering from so-called dyspepsia, had reached the point where she could not keep a thing in her stomach. Even water was immediately ejected from the irritable membrane. She was reduced in weight from 140 pounds to about 90. She had been in care of a number of the best physicians, one of them her son, and had taken probably hundreds of combinations of various drugs. She was then said to be the hopeless victim of "pernicious anemia." Sounds well, doesn't it? Such an encouraging term!

Well, some one suggested buttermilk—just common, old-fashioned,

fresh buttermilk. At first she could retain but a small teaspoonful. But the stomach recognized that at last a friend had entered the door and grew tolerant. But it would have nothing else. For six weeks buttermilk was her exclusive medicine—and her living. She gained twenty pounds weight, with color and hope. Then gradually she could take other food. Six years have passed. She is well, weighing 150 pounds, and never a drop of medicine since Dr. Buttermilk took the case.

I suppose that in any town with three doctors and a drug store, if the various prescriptions for dyspepsia issued during twenty years were bottled or jarred it would take a shelf sixty feet long to hold them—possibly three deep. For all such bottles filled in the United States within your lifetime or mine a shelf would be required, I doubt not, ten miles long. It would take an automobile or a Ford half an hour to go past them at ordinary speed. Against that ten-mile row we will put up one bottle of buttermilk. It is worth infinitely more. Suppose the whole bunch were tipped into the Pacific without possibility of reproduction, how much value would be lost? But we couldn't spare the milk—"sweet or buttah." We could spare the drugs because they represent for the most part pure superstition; the idea that in some mysterious way cures may be effected by agents that have no place in the animal economy. These are usually poisons in some degree, each kicking up its own peculiar kind of a row in blood or brain and particularly nerves. These rows or "effects" are supposed to be of value. In my opinion their service is equivalent, as a rule to that of *Taurus, among the tables of porcelain.*

It was a disturbing thought to me when a young man engaged in general practice that I should be giving daily to others powders, pills and tinctures that I would not wish to take myself in similar conditions. For I had tried out drugs a hundred times for my own ailments with earnest desire of benefit, and had to believe that with the exception of local applications and quinine (undoubtedly a specific blood germicide) I had received more harm than good from their employment. But it was the practice. People demanded just that sort of thing to which they had been accustomed. To attempt the rôle of a reformer and make a living was impracticable; to be a hypocrite, I had no talent.

I have found dentistry more consistent for me than prescribing ten grains of mystery every four hours, or bread pills or sugar-coated pellets of nonsense. Remember, this was nearly forty years ago.

Now, I do not wish to make my criticism entirely destructive. What I object to is *blind* medicine.

If drugs are to be used at all, their use should have a relation to a real physiological process; to biology, to bacteriology, to specific causes. It has a large field in local application in antisepsis, surgical and otherwise; but beware of its introduction into the human stomach. And we shall be more and more careful as time goes by as to what we force into the blood stream of life.

Therapeutic and Surgical Treatment of Roots and the Adjacent Tissues.

By J. F. Biddle, D.D.S., Pittsburgh, Pa.

In the presentation of this subject, I shall deal only with those diseases of the dental pulp which result in apical involvements. It will be my aim to show results of the condition often termed a "simple abscess," which the patient is frequently told "does not amount to anything," although it may have had a known existence of five or ten years.

For convenience of study, these may be divided into two classes:

1. Simple abscesses (a) with sinus, (b) without sinus.

2. Complex abscesses (a) involving one or more adjacent teeth, (b) involving maxillary and other sinuses, (c) involving general health of patient.

Treatment of Simple Abscesses Without Sinus.

In the treatment of simple abscesses without sinus, it has been only within the last few years that we have had anything like a definite working basis, whereby to be reasonably sure, having sealed a tooth, that it might be permitted to remain sealed for twenty-four hours. I refer to the use of formo-cresol, which assuredly has been one of the greatest aids to the modern treatment of pathological conditions of the pulp. Its record in the school with which I am connected is that in twenty-two cases only, of two thousand, did the patient return before the specified time on account of pain resulting from its application, while of the same number of cases treated with this agent and the roots subsequently filled, in thirty-four cases only did the teeth have to be re-treated, or extracted; marvelous results when one considers them a record of students' work in clinics.

Under no condition should the canal of a tooth be left open for drainage of pus and gases while it is being treated. By doing so, the operator is simply wasting his time and reinfection will certainly follow. At the first sitting, the cavity of decay in the crown of the tooth should be thoroughly cleansed of all débris and carious dentine, and the roof of the pulp chamber be removed. The removal of the contents of the canal, however, should never be attempted at this time. A treatment

of formo-cresol follows, to be placed in the pulp chamber, but never forced into the canals, great care being exercised in sealing it, lest pressure be created and some of the decomposed pulp material be forced through the apex. If these directions be followed carefully, soreness rarely results, as the formo-cresol neutralizes, or prevents the formation of irritants by the micro-organisms. Even if gases or pus be present, the tooth should not be left open, but if drainage be deemed necessary it should be established by opening through the tissues at the apex of the root, an operation that may be painlessly accomplished by one of several methods that have recently come into general use.

Twenty-four hours is sufficient time to elapse after the first treatment of formo-cresol, when it should be removed. The canals are then cleaned and washed with sterile water, a second treatment usually being applied for another twenty-four hours; this is followed by a test treatment of oil of cloves, which is allowed to remain for several days, after which the canals are filled. If the tooth does not respond after the second treatment, drainage should be established by an artificial sinus through the tissues at the apex of the root, especially if pus be present; this to be followed by the 50 per cent. sulphuric acid treatment, which consists of placing one or two drops of sulphuric acid in the canal and creating pressure by means of unvulcanized rubber until the acid is forced through the sinus. Its passage through the fistula is made known by its bubbling when it comes in contact with a quantity of bicarbonate of soda which has previously been placed at the opening of the sinus to neutralize the acid and to prevent its making its way along the gum tissue, which would destroy its external membrane.

This is followed by about two ounces of normal salt solution to cleanse thoroughly the canal and apical tissues by forcing everything before it. For this purpose I use a fine platinum point, hard soldered to the shank of a hypodermic syringe nozzle and attached to a syringe. The platinum point is forced through a piece of unvulcanized rubber into the canal as far as possible, the rubber being packed tightly into the cavity and held there. By exerting pressure on the piston, the solution is forced through the canal to irrigate thoroughly it and the sinus. This method is not advisable in the treatment of upper posterior teeth unless the maxillary sinus has been definitely located. There is no good reason for not filling the roots immediately after this treatment, for if the condition be not cured it will require surgical interference, hence further treatment through the canals would be useless. If trouble follows this *modus operandi,* the root filling should not be removed, but the tooth should be extracted, or the operation of removing the apex of the root and all adjacent necrotic tissue should be resorted to.

The Field of the Dentist.

The questions now arise, "How much of an operation is the dentist justified in performing? Should the operation be performed in the dentist's office or in a hospital? What agent for relieving pain should be used, and by whom should it be administered?"

Undoubtedly, the dentist should be qualified to perform all operations in the oral cavity whose source of trouble is the teeth. However, if involvements occur through neglect, or if the disease be malignant in its character and vital parts are apt to be affected, by all means call in a general surgeon in consultation, but keep in active touch with the case, as it is only by actual experience that one becomes familiar with diseased oral conditions and is enabled to assume charge of the more difficult cases.

The next thing to determine is the part of the work to be accomplished in the dental office; the part in the hospital. Broadly speaking, I would say that cases requiring the administration of a local anesthetic could be taken care of in the office, where one's instruments and assistant are at hand. Moreover, the patient is conscious and in no serious danger; therefore, why submit him to the needless expense, annoyance and inconvenience of going to a hospital? Perhaps some may say, "We do not have the proper means of sterilization in our offices." If not, we should have; besides, we are working in a confined area.

Preparation of Field for Operation.

The first precaution is to remove all food débris and calculus from the teeth. Have the teeth thoroughly cleaned with a new sterile brush and a good tooth paste, after which the mouth should be rinsed with normal salt solution and parts to be operated upon should be swabbed with iodine. Any method which would cause absolute sterilization of the oral cavity would cause also loss of tissue and therefore is not to be considered. The operator's hands should now be made sterile and his operating instruments which have been sterilized after the last operation, first by mechanically cleansing, then by boiling and placing in formaldehyde, or solution sterilizer, should now be removed and placed in a sterile tray. Cases requiring the use of a general anesthetic should, as a rule, be treated in a hospital, but many of the minor oral operations might be done more advantageously in one's office.

Importance of Diagnosis.

A most important point is to be a good diagnostician, as many grave conditions often result from the lack of correct diagnoses at the proper time. In making a diagnosis, one must be able to differ-

entiate between the feel of healthy and necrotic bone. If one has access to a good pathological laboratory, where specimens may be taken for examination and study, it will prove a source of immeasurable benefit. One of the greatest modern aids in diagnosis is the radiograph, without the assistance of which our greatest efforts would be, at best, uncertain. Let us bear in mind, however, that the radiograph, while of inestimable value as an aid to diagnosis, is only a shadow picture, which fact we must take carefully into account in making many of our deductions.

Fig. 1.

Fig. 2.

Sometimes, as the illustration will show, it is even necessary to distort the image.

Fig. 1 shows a radiograph taken at the correct angle, with a root filling extending into the canal apparently about two-thirds of the way; also a broach, extending apparently along the side of the root filling. As sensation was noted, and it was certain the pulp was destroyed and that the broach did not extend to the apex, a radiograph was taken by placing tube to the right of tooth instead of directly over it. This picture actually distorts the tooth, but shows that root filling is not in the canal and that the broach extends through a labial perforation. (Fig. 2.)

Undoubtedly, a dental radiograph to be of value should be taken by a dentist rather than a medical practitioner, who is usually no better qualified to take dental radiographs than are we to take radiographs of many parts of the body requiring an exhaustive, painstaking and thorough technique. Let us now consider a few cases:

Case I. This illustration (Fig. 3) reveals the results of leaving the apex of the first bicuspid root, causing the loss of the cuspid and lateral teeth with the

removal of all the labial plate, cancellated structure and part of the lingual plate of bone surrounding them, besides the decomposed pulp of the right, central, incisor tooth.

Case II. Patient, male, thirty-three years of age. Lateral incisor tooth susceptible to thermal tests. Patient consulted a dentist, but was advised that the tooth was all right. Several months later, the tooth responding to percussion, he again consulted a dentist, whereupon the gum was painted with

Fig. 3—Case 1.

Fig. 4—Case 2.

aconite and iodine and the patient dismissed. A month later he consulted another dentist and a sinus was noted, but he was told it did not amount to anything. One and a half years after the first indication of trouble, the patient was referred to the writer for treatment. A radiograph was taken and revealed an impacted cuspid tooth which had become encysted and had affected the lateral and central teeth (Fig. 4).

Had the tooth been radiographed when the patient was first conscious of its response to thermal changes, the cuspid tooth could have been removed and the other teeth saved; whereas it was now necessary to remove the three teeth and the surrounding bone, leaving an opening of about one and one-half inches from the gum margin up along the side of the nose. Upon healing, the tissues were filled out with plumpers on a denture.

Case III. Patient, male, age fifty-six. One and one-half years ago the patient began to notice a peculiar feeling in the nerves and muscles all over his body. Presently the pain became more marked in right knee, left hip, along the sciatic nerve and across the back. The patient was confined to bed for about two months, after which he much improved until autumn, when the muscles and joints again stiffened and he went South to escape the

rigors of the severe northern climate. About five months ago the stiffness of the muscles of the left shoulder, back and hips became more marked than at any previous time, the patient being unable to arise or to dress without assistance. Became troubled with constipation and occasional passages of mucus, sometimes mucus and pus being noted.

About two and one-half months ago the patient was subjected to a thorough physical examination with the following results:

Fig. 5—Case 3.

Fig. 6—Case 3.

Color—Good.
Weight—156¼ lbs. (Normal 190 lbs.)
Blood culture—Negative.
Wassermann reaction—Negative.
Urine—Normal.
X-Ray examination of chest and clavicle—Negative.

On account of his having a large amount of unsanitary bridgework in his mouth, also a marked condition of pyorrhea alveolaris, it was decided to radiograph the patient's teeth. Besides discovering a number of abscesses, it was found that many of the roots of the teeth had been left under the bridges with their crowns cut off and at that no attempt had been made to fill the roots, or to close over the orifice of the canals to keep out the food débris (Figs. 5 and 6). The patient was advised to have all the bridges and remaining teeth removed. He decided to have only the worst teeth extracted, but upon our refusal to have anything further to do with the case unless all teeth were extracted, and having conclusive evidence that nothing could be found from his physical examination to account for his condition, he finally, after about ten days' deliberation, consented to the operation. The teeth were removed and the bone curetted in several places where it was deemed

necessary. Cultures of pus taken from the sockets and apices of the teeth showed streptococcus salivarius (green) and staphylococcus albus. An autogenous vaccine was prepared from the pus. Patient was kept in bed and given a vaccine treatment every third day, which produced a small local reaction about an inch in diameter, associated with a slight systemic reaction (temperature 100°); also a slight focal reaction in involved joints. These symptoms gradually disappeared after several injections. Upon his discharge from the hospital, the patient showed a marked improvement, not only in joint conditions, but in general health.

It is the opinion of the writer that the whole source of trouble was the oral cavity, but although the patient had consulted many eminent physicians all over the country, strange to say, none of them, with the exception of the last specialist, by whom he was referred to the writer. had examined his mouth or teeth as a probable cause of his condition. This is only one of many extreme cases which might be reported if time permitted. However, I shall merely say in passing that we have proved conclusively in a number of cases, by radiographic and pathological examinations, that the teeth have been the source of blood stream infections, disorders of intestinal tract, arthritis and neuritis, whereas in one case the discovery of an impacted molar saved a patient from an operation for mastoiditis, of which she had all the symptoms.

Case IV. Patient, male, forty years of age. Symptoms of infection of maxillary sinus. Radiographed from central to third molar tooth, but radiograph revealed no infection of the teeth that might be contributory to the disease (Fig. 7). The surgeon was so advised by the medical radiographer, and last September an operation was performed through the nose of the patient. There was a recurrence of the trouble at intervals; finally acute attacks. Just recently the case was referred to the writer, who upon examination of the former radiographs of the case found that the teeth had not been radiographed at the correct angle to secure results. Accordingly, the molar teeth were again radiographed, and it was found that the second and third molar teeth extended into the sinus with considerable loss of surrounding osseous structure (Fig. 8). The teeth were extracted and found to be covered with a viscid yellow pus, a careful examination showing that every particle of peridental membrane had been resorbed. The process to and including part of the floor of the sinus was picked out with a pair of foil carriers. Had this later radiograph not been taken, the surgeon would have operated again through the nose. In this case the correct radiograph was the only means of a true diagnosis, as the teeth were firm; there was no sinus

or no discoloration about the gums indicative of the source of the trouble.

Case V. This radiograph (Fig. 9) shows the results of an incorrect diagnosis by several medical practitioners. Within five years this patient had seven operations performed on the maxillary sinus through the nose and abso-

Fig. 7—Case 4.

Fig. 8—Case 4.

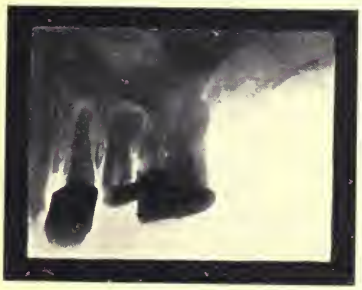

Fig. 9—Case 5.

Fig. 10—Case 6.

lutely no attention was given to the teeth. He is a man of great wealth, actively engaged in business, and consequently the inconvenience and annoyance he experienced were considerable. His dentist started to treat the molar tooth, but being unable to arrest the flow of pus, referred the patient for a radiograph. The radiograph revealed the condition as noted, and his dentist removed the molar tooth. The process was denuded and almost black and the wound refused to heal; hence he was again referred to the writer, an examination revealing that the membrane of the maxillary sinus had been entirely removed by the seven preceding operations through the nose; consequently no hope of a cure could be offered. The second bicuspid tooth with the process

that had surrounded both teeth was removed, the wound closed, and for nearly two years the patient has had no discharge through the mouth. At the present time his only discomfort is that he has to syringe the sinus through the nasal cavity about twice a week with a pint of salt solution. The former offensive odor which had characterized his close approach has entirely disappeared. If this case had been correctly diagnosed at the time of the first operation, doubtless the patient could have been cured.

Case VI. In this case a perfect amalgam filling was removed and a gold one inserted. The gold filling, causing an inflammation of the pulp, had to be removed and the pulp devitalized. It became infected during the operation and soon involved the maxillary sinus. The patient was operated upon at three different times, and at the time she came under the observation of the essayist her health was impaired, and the discharge of pus from her nose and her mouth was so offensive that it was almost impossible to talk with her, except at a distance. The case was operated upon again, but the membrane of the sinus was found to be practically destroyed and the cavity filled with polyps. A telescope crown with a small saddle and tube extending into the sinus was made for the first bicuspid tooth (Fig. 10). A silver point was made to fit the tube to which is attached a rubber bulb syringe, holding one pint. Each morning the patient uses this syringe filled with normal salt solution, and holding the head forward the sinus is irrigated, the solution coming out through the nose. This treatment has been going on for two years, the patient's health has improved and the disagreeable odor has disappeared.

One should not arrive hastily at the conclusion that all diseases of the maxillary sinus have their origin in the teeth. In fact, but a small percentage, some authorities quote 10 per cent., are attributable to this source. Within the past three months I have had three cases diagnosed, both by dentists and surgeons, as diseases of the maxillary sinus. In each case the line of demarcation between the diseased area and the sinus was very slight, but each yielded successfully to the extraction of the denuded offending tooth and the curettment of the necrotic bone with free irrigation of the cavity with normal salt solution.

Formerly diseases of the pulp and the apical tissues were treated with a great variety of drugs. Our present method in this respect has been gradually evolved, the tendency being to discard the use of many remedies and resort to the more rational method of free drainage, less medicine, and to give Nature an opportunity to help herself. For the treatment of such conditions the writer makes use of formo-cresol.

iodine, normal salt solution, and sulphuric acid. With cases that do not yield successfully to any of these agents, the alternative is the bur, the curette, and at times the forceps.

While I do not wish to be reactionary, it is my belief that many of us in our zeal to substantiate the theories of some of our recent investigators are making too many claims regarding the teeth as a factor in controlling diseases, both local and general. So far as the general public is concerned, we cannot urge upon it too strongly the importance of the proper care of the oral cavity, as the gateway to the digestive tract, but as a profession, let us hesitate to make the teeth the fertile cause of various disorders, without due consideration of the premises upon which such conclusions are based.

Pain—Its Advantages and Disadvantages—Its Value as a Diagnostic Symptom and the Importance of Its Alleviation and Prevention.

By Egbert T. Loeffler, D.D.S., Ann Arbor, Mich.

Introduction.

In the preparation of this paper the writer has at all times endeavored to keep within the time limit. In such an attempt two guiding principles should be kept in mind: first, simplicity and clearness in the presentation of facts and theories; and second, judicious limitation of the material selected. In regard to the second principle every experienced specialist is aware of the large number of researches that have been and are being published in experimental pharmacology and the other closely related sciences, and the difficulty of justly estimating the value of conflicting results.

It has been said by an eminent authority that, "He who seeks for the truth in any matter under discussion is oftentimes forced to be satisfied with a suspension of judgment; and he who attempts to formulate our present knowledge upon any part of a subject under consideration is in many instances obliged to present the literature and bare facts in the case as they exist and let the reader or auditor make his own deductions." Such a method doubtless seems to be the most satisfactory and the most suitable for the specialist or the advanced student, but for the beginner or even the average practitioner it is absolutely necessary to follow a different plan. As has been stated above in any discussion the amount of material and the time given to details must be brought within reasonable limits. A great share of the responsibility must be assumed in sifting the evidence, and the conclusions that seem to be most justified by experiment and observation emphasized. As far as the selection of material is concerned, what to give and what to omit, is a matter of good judgment and experience upon the part of the writer. This selection, however, should be made by a process of elimination rather than condensation.

The obstacle most frequently encountered, however, lies in the complexity of the subject, the large number of more or less disconnected

facts and theories which must be considered in the discussion of any phenomenon pertaining to so intricate an organism as the human body. Facts and principles offer no intrinsic difficulty to prevent them from being stated so clearly that they may be comprehended by anyone who possesses an elementary knowledge of the sciences fundamental thereto. It is doubtless then, the art of presentation that makes an attempt like this successful or unsuccessful.

Again, some critics have contended that only those facts or conclusions about which there can be no possible difference of opinion should be presented. There seems to be no valid reason, however, to present only those conclusions that have crystallized out of the controversies of other times and ignore entirely the live issues of the day which are of so much interest and importance in all branches of medical science. To emphasize this fact as well as to add somewhat to the interest of the subject under consideration short historical résumés have been introduced at intervals, although the question of time alone, not to mention other considerations has prevented any extensive use of such material.

Discussion.

Not infrequently we find that pathological processes and peculiar functional elements, even with a careful and critical consideration, seem to obscure the clinical picture and all because we do not have a clear conception of the phenomena of pain. Some eminent authorities claim that all final interpretations of a symptom, so purely subjective, and one involving so many complex psychological and pathological factors, can often be made only after most painstaking clinical observations. Aside from historical facts we are willing to admit that all objective symptoms are extremely valuable for diagnostic purposes. For this very reason, I presume, nearly all efforts in modern medical research, for the solution of diagnostic problems, tend in this direction. Various undertakings in the study of serum pathology and radiology are familiar examples of such efforts. To the casual observer, therefore, it does seem somewhat unwarranted that any undue emphasis should be given any physical manifestation so purely subjective in its nature, and so dependent upon the patient itself.

However, most objective symptoms of disease do not make their appearance until a certain stage of development, while pain is very frequently present at its very inception. Furthermore, under conditions of actual practice, a comprehensive investigation of all objective symptoms is frequently a matter of great difficulty, owing to the absence of the necessary facilities, and therefore, a careful consideration of the patient's own sensations is absolutely essential.

Not infrequently it is the very symptom of pain that impels the

patient to seek medical or dental advice and it will therefore be the starting point of the diagnostic train of reasoning, while its correct interpretation is the first requisite to the institution of a suitable form of treatment. On the other hand, the writer might add, that during his twenty-five years of active practice and also during his service as clinical instructor in dental therapeutics, which brought him in constant touch with other members of the clinical staff, he has convinced himself that, even those having satisfactory command of the methods of objective examinations there is a great deficiency in the ability to make use of the information conveyed by the manifestations of pain.

The many advantages and disadvantages of pain require no preliminary explanation but will be brought out in the further discussion of the subject. Finally, in the analysis of any manifestation of pain, it has seemed to me that, in addition to the organic processes to which they were due and the topographical factors underlying their projection externally, their relationship to function was especially important from the standpoint of facilitating diagnosis. The investigations of painful conditions from this point of view leads to a more intimate comprehension of their pathogenesis and therefore to greater success in treatment.

What is Pain? Definition.

Pain is defined as the true feeling that is the opposite of pleasure; the disagreeable in all its degrees and forms. Specifically it is a disagreeable feeling, usually in its intenser degrees, resulting from or accompanying deranged, overstrained or otherwise abnormal action of the physical powers, and serving as a warning of danger and spur to effort. "Pleasure, on the other hand, is the reflex of the spontaneous and unimpeded exertion of a power, of whose energy we are conscious. Pain on the contrary, is the reflex of the overstrained or repressed exertion of such a power." (Hamilton, Metaphysics, Lect. 42, p. 577.) "Pain is the necessary contrast to pleasure; it ushers us into existence and is the first to give us consciousness; it is the companion and guardian of human life." (Charles Bell, The Hand, Chapter 7, p. 211.)

Gould defines pain as a bodily or mental suffering; a distressing or agonizing sensation. Ache, affliction, agony, anguish, discomfort, distress, misery, suffering torment and torture are given as the most important symptoms.

Pain Classification.

The nature and quality of pain is dependent upon the nature and condition of the tissue involved as well as upon the character of the stimulus or irritation. Shooting or lancinating pain generally indicates carcinoma; burning pain, an inflammation of nerves or

the skin; dull, heavy pain, rheumatism; throbbing pain, an inflammation, with transudation into a dense tissue, as in abscess or whitlow; jumping pain, as in the case of "a jumping toothache." The pain produced in exacting hypersensitive dentine, can hardly be described and belongs in a class by itself.

Pain—Dependent Upon Various Factors.

Location.

Disease is not always at the point where pain is experienced. Disease at the root of the fifth nerve, for example, excites pain in the jaw or face. Many serious errors have been committed in locating disease by the misleading influence of local pain.

Duration or Constancy.

Constant pain is usually inflammatory in origin; intermittent pain, neuralgic. Fixed pain, that which never shifts its position and is continuous for a long time, even though not severe, should never be treated as a light matter. The sudden cessation of pain in an inflamed part often announces the commencement of gangrene. In the case of constant irritation, the ganglionic cells undoubtedly store up this disturbance. This is probably what happens in the case of inflammation induced by a continuous or unusual amount of irritation.

Pain as Compared With Other Sensations.

In the simplest organisms there is no differentiation of sensory organs, and consciousness probably shows no difference whatever. All stimuli give rise to exactly the same effect. Taste is no different from touch, sight and hearing—if hearing be present at all. All forms of stimuli excite the same organ and in consequence give the same effect. In man, however, we have four distinct sensations on the skin alone. The sense of pain and pressure which respond to mechanical stimuli, and the sense of heat and cold which respond to temperature changes. Of all these the sense of pain is the most widely distributed. Nearly the entire surface of the body is covered with so-called "cold spots," "warm spots," "pressure spots," and "pain spots." Pressure spots are relatively easy to excite; pain spots on the other hand, are much more closely crowded together and are stimulated with greater difficulty. Pain is not merely a more intense pressure, as was thought for a long time, because there are certain parts of the body that are sensitive to pressure but not to pain, as the inner membrane of the cheek, while the cornea of the eye always responds to pain, never to pressure, no matter how slight the excitation.

Again, certain drugs destroy one sense quality and leave the other

unaffected, as cocain when first applied, destroys the sensations to pain, but not to pressure; a rarer drug, saponine, destroys sensations to pressure but not to pain. It is generally held that pain and pressure are distinct senses with distinct kinds of sensory nerve endings in the skin. The nerves of pain are the free nerve ends that extend into the outer skin, and that pain has a very superficial organ is evident from the fact that an acid will give rise to pain before it affects any other organ.

Pain; Its Variations.

There may be considerable variation in the character of pain. Some authorities claim that by a mixture of sense perceptions, burning pains may arise; by a process of expansion or localization, pricking pains; by altering the stimulating process, throbbing pains. Again there are psychic factors that have an important influence in modifying the intensity of pain. The importance to be attached to pain must be regulated in some degree by the temperament of the individual suffering it. There are persons whose nervous system and whose mental and emotional nature are so constructed, that the slightest pain is followed by extravagant or exaggerated manifestations of suffering; while there are others, heavy and phlegmatic in their organization, or possessing an iron will, who either do not feel pain as much as others, or who endure it with singular fortitude and stolidity. There are other factors that have more or less influence in the manifestations of painful sensations, as intelligence, education, character, age, sex and general health. As has been intimated there are those individuals in which the neuropathic constitution causes very painful impressions to be perceived in a greatly magnified form. On the other hand, there are those who make every attempt to mislead the examiner. In such cases more attention should be given to facial expression, or rather to the reflexes in order to estimate the severity of the pain.

Purely quantitative variations are dependent upon two factors; the intensity of the stimulus and the sensitiveness of the registering apparatus. The same stimulus or irritant may be endurable to one and seriously disturb the physical equilibrium of another.

Time.

The time of day, the seasons, or even distinct phases of development have a decided influence in causing a variation in painful affections.

Not infrequently the onset of pain is associated with some definite hour of the day, or exhibits a regular dependence on certain occurrences, such as the ingestion of food or it may appear at some stated time of day as in the case of nocturnal pain.

Pain; Its Advantages or Benefits.

Pain in itself is a phenomenon wisely instituted by Nature. The importance of this statement can best be appreciated by quoting a few paragraphs from the contributions of Prof. Goldscheider, of the University of Berlin, in which he says: "Pain makes us realize that some external danger is threatening which we may still avoid, or that harm has already been done to the body requiring our care if we would escape more serious consequences. Pain arises as a warning signal whenever we are exposed to such conditions of life as by their continued influence would involve general disturbances of health. Pain appears before or simultaneous with the outbreak of disease, warning man that his body is in a diseased condition and requires care. Pain occasioned by physical or mental fatigue indicates necessity for rest and recreation. Pain, the symptom of organic disease, imperatively urges the patient to save the diseased organ. Pain is the physician's most powerful assistant, whose demands the patient follows in blind obedience, and who saves the physician many a prescription and many an advice as to diet and conduct. Through pain, Nature imposes rest, even upon the most strenuous; it dictates idleness to the most energetic, and forces the most obstinate to abide by conditions suitable for the diseased body. Pain is a harsh but useful law of Nature. But like all natural laws, it is unyielding in its consistency, blind in its disregard, brutal and cruel. Pain appears not only in the guise of benevolent warning, but also in that troublesome torment. Even in incurable disease, in affections in which the realization of ill health is useless for the patient, inasmuch as no one can control the disease, pain is present, ruthlessly destroying all enjoyment in life without offering any physical advantage whatever by way of compensation. In the most dangerous disease pain is often absent, thus lulling the patient into a sensation of security, only to appear and call for abolition by artificial means after the patient has undergone an operation in order to save his life. Hence it is only proper that we physicians should combat our ally; for to wipe out pain entirely is an impossibility, and we cannot and would not do without it, since pain is necessary, not only as a monitor in the combat against hostile powers of matter, but also as an inspirer to ethical emotion. For it is chiefly in the reminiscence of one's own pain, both physical and mental, that love and active charity is rooted."

Advantages of Pain as a Preventive Measure.

The advantages or benefits of pain incident to all or nearly all diseases of the oral cavity can be very readily demonstrated by the in-

creased interest or early attention given to this most faithful guardian of human life.

Dental Caries.

The ravages of dental caries is often cut short by the timely warning given by pain. An early visit to the dentist has saved many teeth from injury beyond repair. Without heed to this warning, or when the symptom of pain is wanting thousands upon thousands of teeth have been lost. This statement is true in the case of any disease unless preventive measures are applied.

As has been stated in a previous part of this paper, it is the pain that impels patients to seek medical or dental aid or advice. It may therefore be considered the starting point of every method of diagnosis, while its correct interpretation is the best means for instituting a suitable form of treatment.

There seems to be an impression in the minds of many patients that all such pain is useless and unnecessary. It is true that much of this form of human suffering is unnecessary when it has served its purpose as a timely warning. There are those also in which the symptom of pain seems to be wanting. In these very cases, however, we find that the disease, in many instances, is allowed to progress without interference until serious damage has been done. Of all the symptoms of disease, as heat, redness, pain, swelling and perverted or loss of function, pain with but few exceptions is the sole cause for bringing the patient to the office of the physician or dentist. Pain, therefore, is a constant reminder that some diseased porton of the body needs attention. In the case of exposed or nearly exposed pulps, acute or chronic dento-alveolar abscess, pericementitis and pyorrhea alveolaris it is the discomforting sensation of pain that constantly reminds the sufferer that something should be done to arrest the progress of disease and assist Nature in effecting a cure.

Advantages of Pain in Making a Differential Diagnosis.

The peculiar variations in the nature and character of the manifestations of pain due to disease in the oral cavity is very striking. The throbbing pain of a hyperæmic or inflamed pulp, which often cannot be localized and may simulate the character of neuralgia is a typical example. The peculiar pain produced by hypersensitive dentin may readily be distinguished from any other. That feeling or sensation of tenderness and fullness, as if the tooth protruded from its socket, as manifested in the case of a pericementitis can frequently be differentiated from the periodical dull pain produced by a chronic dento-alveolar abscess. A severe form of throbbing pain, definitely localized, and characterized at

intervals by spasmodic attacks is easily diagnosed as a case of acute dento-alveolar abscess. The pain produced by some phases of pyorrhea alveolaris partakes more of the nature and character of a chronic pericementitis. As has been stated, the objective evidences of disease often do not appear until the abnormal condition has reached a certain degree of development, whereas the symptom of pain is not rarely present at its very inception. Besides a comprehensive investigation of other symptoms may not be feasible for the want of proper facilities.

The Disadvantages of Pain. Early Views on the Subject.

There was a time when skillful surgeons and eminent divines contended that pain was a natural protection, a necessary stimulant to the reparative process, and a Providential dispensation, and that the prevention of it was defying the Almighty. Now it amounts to inhumanity and malpractice to presume to do any severe operation without abolishing it.

Professor Charles D. Miegs, of the Jefferson Medical College ot Philadelphia, as late as 1856, wrote of the "doubtful nature of any process that the physician sets up to contravene the operation of those natural and physiological forces that the Divinity has ordained us to enjoy or suffer."

During the same period a clergyman wrote to a medical friend as follows: "Anesthesia or any agent used to prevent pain is a decoy of Satan apparently offering itself to bless women; but in the end it will harden society and rob God of the deep, earnest cries which arise in time of trouble for help."

From the history of dental medicine we find, however, that the great problem of the prevention of pain received earnest and persistent attention on the part of many of those who practiced the healing art. We also find that no branch of this art and science seemed to be better suited for the investigation of this most difficult problem. As compared with other surgical interventions, operations in the oral cavity, with but few exceptions, are so extremely painful, that operators from time immemorial have had a special desire to diminish or to prevent entirely all painful sensations from this source.

The Prevention of Pain as a Factor in the Evolution of Dental Surgery.

Just as the discovery of anesthesia or the means of preventing pain has revolutionized general surgery, so has it affected dentistry. It is perfectly wonderful what a change it has made within a few years; the effect on the science was more gradual but none the less radical.

Dr. William J. White, Professor of Surgery in the University of Pennsylvania, in his address on *"Anesthesia as a Factor in the Evolution of Surgery,"* makes the following statement: "Like the enchanted carpet of the Arabian Nights, it transformed them in the twinkling of an eye from the glaring light of one atmosphere to the soft darkness of the antipodes; from an atmosphere of pain, suffering and agony, of tense nerves and noisy struggles, of mental horror and physical anguish, to one of quiet slumber and sweet oblivion. If it had done nothing more for the victim of surgical disease and injury than to blot out the pain which from the very earliest dawn of surgery was inseparable from its procedures; if it had done nothing more for the operator than to transform the shrieking, writhing patient, strapped to the table and held there by stalwart assistants, into the passive, unresisting and unconscious subject of his knife, it would have justified, a hundred times over, any amount of effort to commemorate this event. It would have been an achievement beyond all praise to have diminished by this much the sum of human suffering, to have added by this much to the efficiency of surgery, if it had done nothing more.

"But the most obvious and immediate result of the discovery of the means for preventing pain were the very least of the blessings that were to spring from it. It is not too much to say that it and it alone brought into the realms of possibility every great advance which has succeeded it. Dozens of modern operations, unknown in 1844, each of which has been followed by a reduction in mortality, affecting tens of thousands of patients, owe their birth to our ability to secure absolute quietude and full muscular relaxation." Some of the wonderful operations of to-day would have been considered impossibilities fifty years ago. Any professional man, at that time, even suggesting the invasion of such territory would have been classed among the criminal lunatics.

Any of the distinguished surgeons of that day, as Valpeau, Dupuytren and others, were simply helpless in the presence of cases that are very readily treated or operated upon by any of our recent graduates. Again, it might be said that since the advent of painless surgery the field of operative work has broadened and the experimental research upon the lower animals made possible the discoveries of Pasteur and Lister some years later. All these discoveries have been the means of saving weekly more lives than were sacrificed in the campaigns of the Cæsars.

Investigation, experiment, and research are going on more rapidly than ever before. The possibilities in the field of dental surgery alone are just beginning to be realized.

The Relief and Prevention of Pain.

The relief and prevention of pain, in case of all inflammatory processes, has received marked attention at the hands of such men as Dr. Spiess. The above authority states that: "The chief object of anesthesia in the therapy of inflammation is to bring the anesthetizing agent in such frequent and intimate contact with the wound that the subjective painful sensations are prevented or reduced to a minimum."

The appearance of the wound and the severity of the inflammation correspond in may respects to that of the patient. Absence of pain, total or partial, permits of a safe termination as to the total or partial absence of inflammatory reaction. Many practical applications of this nature have been made in diseases and injuries in the oral cavity.

In the case of injuries to the tongue, even the disagreeable sensation of incipient nasal catarrh, are relieved by the insufflation of orthoform or novocain in the nasopharyngeal cavity. By repeated applications many cases of coryza have been aborted with absolute certainty.

A large number of experiments have been made with a view of modifying the healing process. By abolishing pain the redness disappears. Both are brought about by reflexes and may in the same way be abolished by the same agent. The vaso-motor, or sympathetic nervous control of the vascular system, however, must not be interfered with. Novocain seems to possess this property of abolishing pain and the reflexes that produce redness.

Central irritation is prevented by relieving the local symptoms. This morbid condition in the brain, however, is so readily influenced by various other reflexes that all agents used as sedatives should be used at the very beginning of the disease. By means of anesthetics properly administered, inflammation may be entirely prevented, as has been demonstrated in the extraction of teeth and similar operations.

The Relief of Pain.

To allow pain to continue after it has served its purpose as a warning signal is of no use and in many instances entirely unnecessary. Every effort should be made on the part of the patient and operator to abolish it. The sensory nerve centers in the brain are very susceptible and often injured in a marked degree by prolonged pain. Both local and general remedies should be used for the relief of pain if it cannot be accomplished in any other way.

In the application of remedies for the relief of pain we must not forget that we have another duty to perform and that is to determine the cause and if possible remove it. I would not have you understand that

you should rush for some remedy with which to club into insensibility every symptom of disease as soon as it puts in an appearance. Give Nature a little chance to show what she intends to do before attempting to stop her by dosing yourself with some pain-reliever or colic cure. Do not trust her too blindly, however, for the best of things may become bad in extreme, and the body may become so panic-stricken as to keep on throwing overboard, not merely the poisons, but its necessary food, if the process be allowed to continue too long. This is where the doctor comes in. This is the point at which it takes brains to succeed in the treatment of disease or the alleviation of suffering—to decide just how far Nature knows what she is doing, even in her most violent expulsive methods, and is to be helped, and just when she has lost her head, or got into a bad habit, and must be thwarted. This much we feel sure of, and it is one of the keynotes of the attitude of modern medicine, that a large majority of the symptoms of disease are really Nature's attempts to cure it. In short, it is our duty to trust Nature instead of defying her, co-operate with her in place of fighting her.

Pain, wherever found, is Nature's abrupt command, "Halt!" her imperative order to stop. When you have obeyed that command, you have taken the most important single step towards the cure. A headache, for example, always means something—overwork, underventilation, eye-strain, underfeeding, infection. Some error is being committed, some bad physical habit is being dropped into. There are a dozen different remedies that will stop the pain from opium and chloroform down to coal tar remedies (phenacitin, acetanilid, etc.) and the bromides. But not one of them cures, in the sense of doing anything toward removing the cause.

To enumerate in detail the best means for relieving all the various forms and phases of human suffering is beyond the scope of this paper. Plenty of pure, cool water internally, externally and eternally, rest, fresh air, and careful feeding, are in some respects the best remedies known to modern medicine.

Pain, its Demoralizing Effect.

Pain has a demoralizing effect on the patient, often beyond our conception. It creates fear and nervous prostration and many other conditions from which it may be difficult to recover. A careful study of the sensory nervous system and its method of operation is all important.

All who have been obliged to observe the effect of human suffering must have been painfully impressed with its power to demoralize.

The demoralization caused by physical pain is something with which all physicians and clergymen are perfectly familiar. It has often been thought and frequently asserted that suffering physical pain has in itself

a certain educative power, and that its intention is to elevate the patient in his spiritual state. Present day observations, so far as I have been able to make out, lead to precisely opposite conclusions. Sharp, long-continued and unendurable physical pain usually has quite as bad an effect on the moral structure of the sufferer as it does upon his physical make-up. so that anything which tends to remove physical pain tends in the same direction as to elevate him morally.

Any man compelled to look continually at physical suffering will himself grow hard. He is forced to do so in self defense. The long continued strain is more than he can bear. The same is true of humanity in general. The simple fact that to such an extent the contemplation of physical pain has been removed from us makes humankind as a whole more human.

A rational application of remedies with a view of combating successfully any painful sensation manifested by a patient, of whatever sort it may be, necessarily requires either the dental or medical practitioner to obtain a clear insight into its sources of origin.

In regard to nerves and their sensations we are concerned only in afferent nerves and especially those that convey painful impressions. With due respect to the time limit, a liberal consideration of this point would not seem out of place. We know less, however, of the nervous system than of any part of the human body. The brain or rather the particular function residing in different parts are as much a mystery as they ever have been. We know practically nothing of the metabolism going on in nerve tissue. The more thorough the investigation in this direction, the more successful and to the point will be the treatment for abolishing the same.

A fundamental principle, and one that should always be kept in mind, is to carefully analyze all forms of pain into its various elements. Such an analysis should always begin by making a careful outline of the seat of pain. In other words to determine its topography. The patient should, first of all, be instructed to point to the exact spot or region where the pain is most intense, and as to whether it is superficial or deep seated. Indefinite statements, however, such as pain in the stomach or pain in the jaw are not infrequently associated with erroneous conceptions. Another point to be observed is a careful differentiation between the painful focus and its radiation, especially when there is no reason for assuming a neuropathic tendency in the patient.

The character of pain, as has been stated, varies considerably, in different individuals. The intensity also varies with the nature and amount of stimulation or irritation and is often dependent upon psychic

functions. There are other factors, such as age, sex, intelligence, nationality and manifestation of painful affections.

The Prevention of Pain.

In a previous paragraph we stated that: "The prevention of pain has engaged the minds and conscientious members of the healing art since time immemorial. The pain incident to all dental operations is useless and entirely unnecessary. On the other hand, it is a decided disadvantage to both operator and patient."

The most approved method to date for the prevention of pain is by means of local anesthetics. The dental profession at least must and will accept a method of anesthesia as devised by Dr. Braun, the father of local anesthesia, which has no mortality. In the application of this method, however, we should carefully note that the reaction of nerve tissue to diminished or interrupted circulation is not uniform. The brain, medulla and spinal cord are very sensitive to fluctuations of blood pressure while the peripheral nerve trunks or endings are independent of the oxygen supply to a great extent and retain the power of transmission hours after the cessation of the blood supply.

Another point of vital interest is that pain sense, of all senses is the most resistant to pressure on the nerve trunks and disappears last. The first senses to disappear are those of touch and pressure, temperature sense occupying an intermediate position.

Disadvantages or Harm to Patient.

The disadvantage or harm to the patient is that it is a useless waste of energy, encourages inferior work and has a general demoralizing effect. The injury to the nervous system is often quite marked. It creates fear or increases it to the extent that much needed work may be neglected or entirely omitted in the future. For example let us assume that on this account a failure is made in some root canal work. Shall we stop to estimate the cost? In the past the estimate used to be the loss of that particular tooth. At this time and age it may mean years of suffering or possibly the loss of human life. If the patient happens to be a dear friend of yours or some member of your own family did you ever stop to think what that means?

Shall we assume that it is the dearest member of your family and that your work is a failure because you have not availed yourself of all the modern means for preventing pain? Let me ask at this time in all seriousness if it is not true that the effort you put forth in this direction is almost directly in proportion to your ability to appreciate a great sacrifice, the inestimable cost in case of failure? There are other causes for such failures. I would not have you misunderstand me. But the most

important factor to be considered in my humble estimation is "the prevention of pain."

In the preparation of hypersensitive cavities the average operator fails on account of the extreme suffering. Many difficult and inaccessible cavities are overlooked and not infrequently improper filling materials are used because of faulty or inadequate preparation for their reception.

Statements are frequently made that the sensation of pain is necessary in the preparation of cavities as a guide to the amount of excavation required, especially when the pulp is being encroached upon. A most timely and appropriate answer to this statement is given by asking another. "Does the general surgeon depend upon the sensation of pain when operating for the removal of an appendix or a stone in the bladder?"

In the operation for the removal of pulps the most important factor to be considered, and one that cannot be ignored to insure good work and the necessary co-operation of the patients is, "the prevention of pain." Unless this condition is complied with pulp remnants are left and at times only the bulbous portion removed.

There are those who are able and often willing to bear the pain in order to have effective work done. A much larger per cent, however, will not tolerate such practice. While pain and suffering have been the sole means of introducing its victims to seek medical or dental advice the fear of the remedy or the method of its application has had a directly opposite effect.

The harm that comes from such practices is manifested in the form of pericementitis, acute and chronic abscesses and not infrequently the loss of the tooth. Case after case might be cited in which faulty work resulted because pain was not prevented. There are other reasons, of course, such as small fees, lack of time, skill and co-operation on the part of the patient.

Since time immemorial the fear of pain in extracting teeth has caused many to suffer untold agonies. There was a long period, it is true, when the means for preventing suffering on such occasions was not at hand. At this time and age, however, with all conceivable forms of remedial agents no such excuse can be accepted, and any operator who attempts to extract teeth, excavate hypersensitive dentin or remove pulps without making some effort, at least, to prevent the suffering incident thereto is considered inhuman and in the language of one authority, at least, is characterized as a barbarian.

The injuries resulting at the hands of such operators are often quite serious; such as fractured crowns and jaws, lacerated gums, unextracted roots, and not infrequently a decidedly demoralized condition of the patient.

As might be expected, lack of co-operation on the part of the patient and hurried operations are largely responsible for such injuries and all because modern methods for abolishing pain have been ignored.

In conclusion I beg of you, as members of the dental profession, to recall to your mind the Golden Rule—"Do unto others as you would that they should do unto you." It is not only our privilege, but our duty as well to utilize every available means for the sole purpose of relieving and abolishing human suffering.

To carry out this principle means more time and larger fees. Most patients, however, are only too willing to contribute more of their worldly possessions for such services, provided they have received the proper enlightenment. Good, reliable and conscientious work is not necessarily expensive. Faulty or inefficient work, on the other hand, is dear at any price.

The principal object for writing this paper has been that I might make a direct and earnest appeal to all members of the dental profession, especially those who have the interests of humanity and their profession at heart, to make it their duty to employ, from now on, all the available means for the alleviation or abolishment of human suffering. Then, and not until then, can we hope to measure up to the standard of our high calling as efficient members of the healing art.

Papers Presented in Section VI.

Oral Surgery.

A Few Thoughts on the Comparative Anatomy of the Maxillary Sinus, Its Relation to the Teeth, Infraorbital Canal and Alimentary System.

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These studies will be restricted to man and a few well-known lower animals such as the ox, horse, pig, dog, lion, etc., etc.

The maxillary sinus of man, and of nearly all the monkeys is largely surrounded by the processes of the maxilla; its nasal wall, however, is partly composed of the palate, ethmoid, larchrymal and inferior turbinate bones, and in recent state by membranous tissue. In some of the carnivora the inner or nasal wall is composed principally of the turbinate bones and membranous tissue.

The maxillary sinus is subject to great variation as to size, shape, subdivisions and other characteristics. These variations are largely in accordance with the type of alimentary canal and food-habit of the animal, which are also indicated by the character of the teeth. The structure of the alveolar process also corresponds to the character and function of the teeth. This means that the maxillary sinus, the teeth, the alveolar process, mandibular articulation and the alimentary system of the animal are all in harmony and to a certain extent interdependent; as will be shown in detail by the study of the various animals.

In the ruminants, such as the ox, sheep, camel, etc., that have a complex digestive apparatus, the maxillary sinus has many divisions. In other herbivora not ruminants, the sinus is not quite so complicated; for instance the horse has a much simpler maxillary sinus than the ox. In omnivora, of which man is the type, there is usually one single maxillary sinus on each side, while in the true carnivora, the maxillary sinus, as a box within the maxilla is absent, although there is a space between the maxilla and the turbinate bones, that might be called a maxillary sinus; but a better name would be maxillo-turbinate cells or sinuses.

Conforming with those variations are to be found differences in the position of the infraorbital canal and foramen and in the structures of the teeth and alveolar process. In the herbivora and omnivora the can-

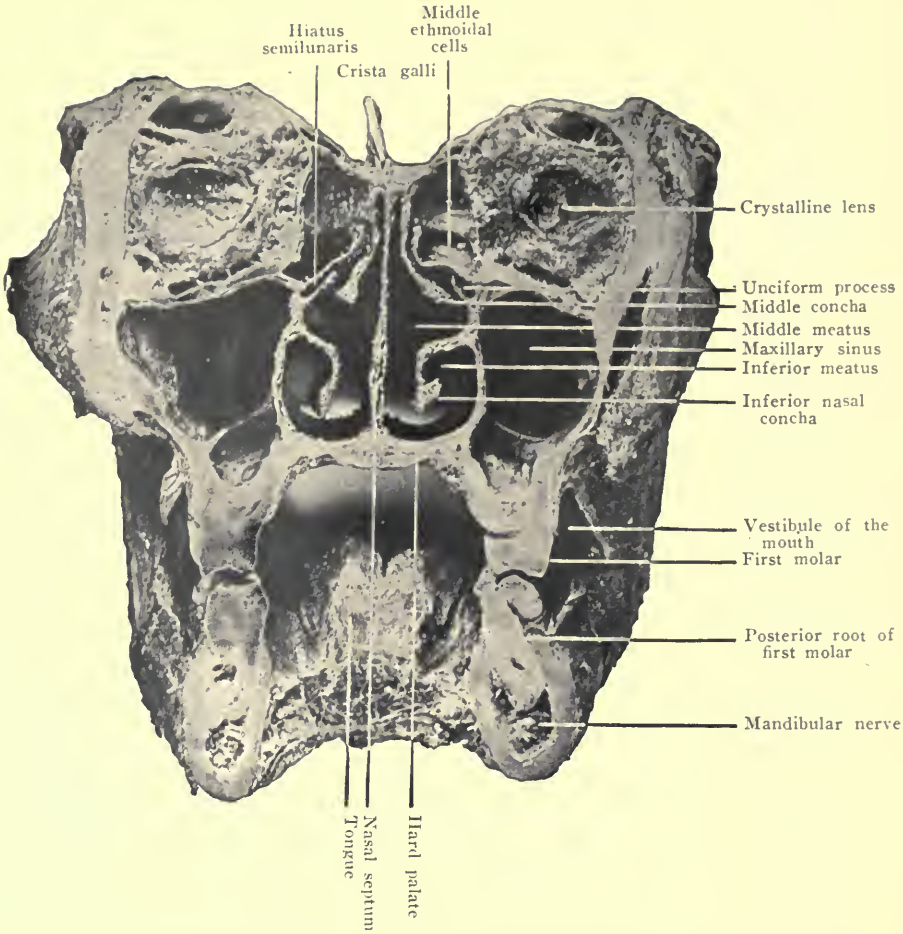


Fig. 1. Anterior view of a vertical section of the head, showing the relations of the jaws, and indicating the positions of the conchæ, antra, etc.

cellated tissue of the alveolar process is made of bone in such a manner that it forms more or less a cushion for the teeth, allowing them slight movement in mastication. In the carnivora the process is more dense and holds the teeth more firmly as they are used for seizing and tearing meat rather than for mastication.

The teeth in the lower types of man are more used for cutting and masticating raw materials and have a deeper and more elastic alveolar process than the highly civilized type. The alveolar process surrounding the individual tooth is also subject to variation; the portion around the

canine tooth is a firm structure, while that around the molar or masticating teeth is more elastic.

Associated with these variations in the maxillary sinus are to be found corresponding variations in the mandibular articulation governed largely by the food habit of the animal. In the ruminant there is a great latitude in the articulation; the mandibular fossa is comparatively shallow which allows a free ruminatory action.

This mandibular fossa deepens and becomes more of a socket to hold

Fig. 2. Posterior view of vertical transverse section of the head from the same skull as Fig. 1, showing the ostium maxillare, which is indicated on each side by a cord passed through it.

the condyloid process of the mandible in proportion to the carnivorous characteristics of the teeth. The anterior and middle roots of the zygoma become enlarged until they grasp the condyloid process, which only allows the motion of a hinge-like joint. In the badger these processes extend downward and around the condyloid process until the mandible is held in conjunction with the temporal bone. The interlocking of the teeth also indicates the character of the articulation, etc., etc.

Maxillary Sinus of Man.

Studies of the maxillary sinus of man have shown that it is generally the largest air space associated with the nasal cavity. It is developed from the ethmoid group of cells invading the maxilla, as other ethmoid

cells invade the frontal and sphenoid. It is usually described as pyramidal in shape with its base toward the nasal cavity and its apex toward the zygomatic bone. It varies, however, in shape, size and in thickness of its walls, not always in accordance with age, race or even with the presence or absence of the teeth or tooth germs. It differs in individuals and even in the two sides of the same skull. In some cases the sinus may even be lacking, the nasal cavity extending outward over the roof of the mouth, the alveolar process and the roots of the teeth, to the outer cortical bone

Fig. 3. Anterior view of a vertical transverse bilateral section of a negro skull, showing a deep alveolar process.

of the maxilla. On the other hand the maxillary sinus may be very large, containing in some cases as much as thirty-five cubic centimeters for each sinus. It may extend in various directions, sometimes encroaching upon the nasal cavity, making that air passage very narrow, especially in the region just above the floor, the two sinuses approaching in some cases to within 13 mm. of each other. In the ox the two left and right "inner" sinuses are separated only by a thin plate of bone. The maxillary sinus of man may be nearly spheroidal in shape without division or pockets; again it may be very irregular, extending into the zygomatic bone or becoming a common cavity with the ethmoid cells and the frontal sinus. The maxillary sinus may be divided by partial bony or membranous septa.

Influence of Infraorbital Canal.

The position of the infraorbital canal with its bony covering seems to be a considerable factor in the variations of the shape of the maxillary sinus. In man the infraorbital canal is commonly described as passing from the infraorbital groove in the middle of the floor of the orbit where, as a canal or tube, it dips down into the floor

of the orbit and passes out on the face to the infraorbital foramen. It frequently passes through the superior anterior portion of the sinus, leaving a space, the "infraorbital cell" above the canal or tube which in these cases is supported by a thin plate of bone. With these great variations in man, one might think that the maxillary sinus of the ox, horse, dog, etc., would also show variations in each class, but the writer has not found it

Fig. 4. A vertical transverse section of chimpanzee face.

to be the case. Each of these animals is more specialized and consistent in its food habit and environment. Man on the contrary varies in his diet, occupation and environment and his anatomy is accordingly modified. On the other hand, in the domestic animals, man is constantly endeavoring to alter the character in order to bring about changes that will make them more useful or to satisfy certain fancies in their appearance. For instance the dog fancier has produced variations in the dog until the skull of a bull-dog is quite different from that of a greyhound. The head of a cart horse also differs from that of a thoroughbred. The head of the almond-tumbler pigeon differs from that of the English carrier. With all the ingenuity of man, however, he has not been able to change the general fundamental character of the skulls and if these artificially produced animals are not supervised in their after-breeding, they will revert to their original types.

Maxillary Sinus of the Ox.

As already stated the most irregular shaped maxillary sinus is that of the ruminant and it will be found to be complicated in about the same

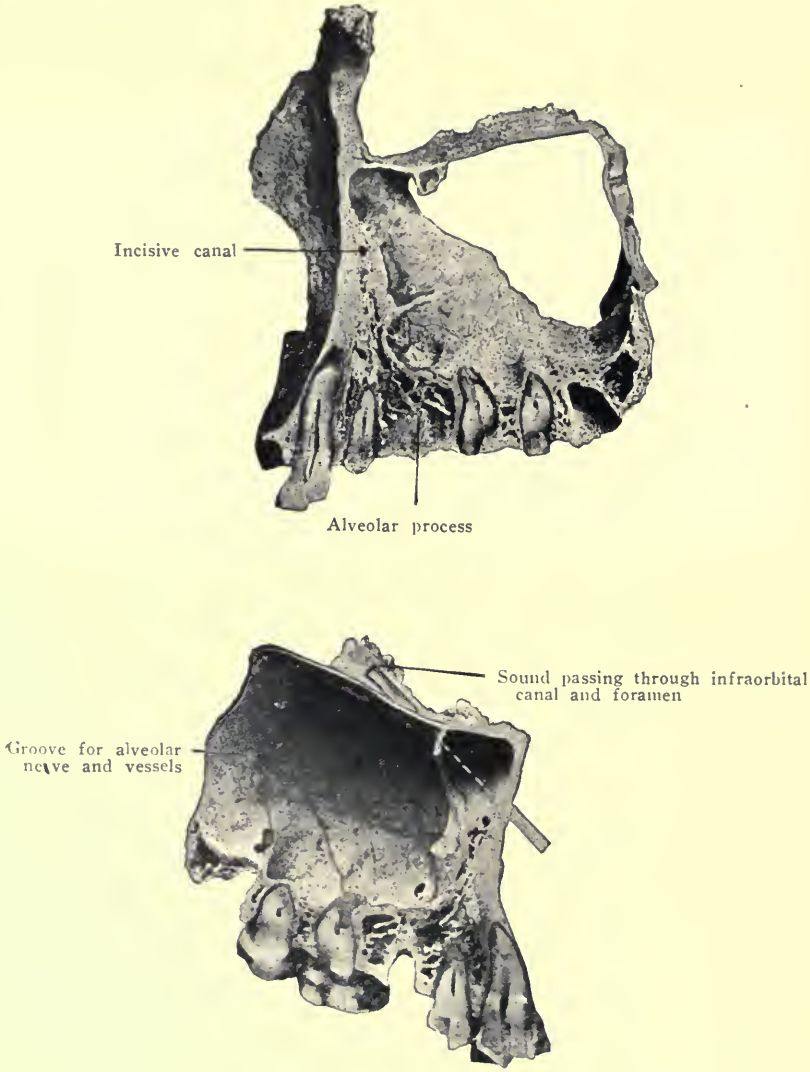


Fig. 5. Antero-posterior section through the maxillary sinus and the teeth, showing an infraorbital sinus above the canal.

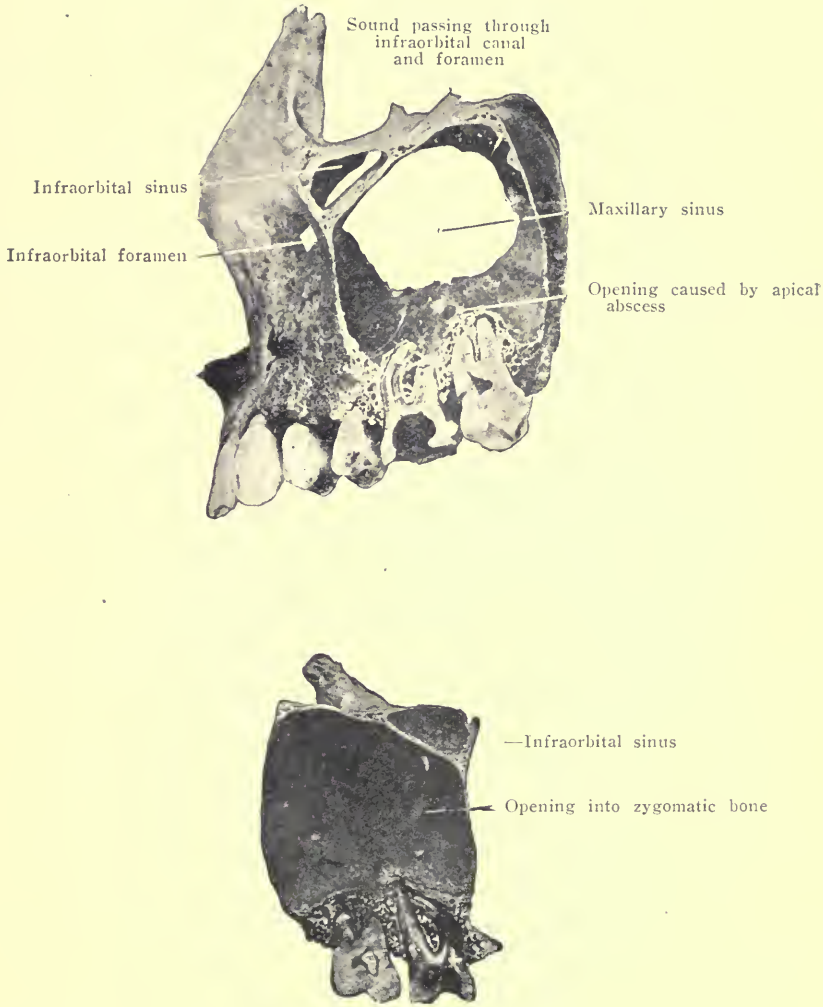


Fig. 6. Antero-posterior section of the maxilla, showing opening of a dental abscess within the sinus. It also shows the infraorbital sinus.

ratio as its alimentary canal, in fact the maxillary sinus is usually complex or simple in its construction in proportion to these characteristics in the digestive apparatus, especially in well-defined herbivorous or carnivorous animals.

The maxillary sinuses of the ox are very large, divided and subdivided. They commence on each side with an oval end in the region of the maxillary tuberosity above and posterior to the third molar tooth, and extend to a point anterior to the first premolar. Each sinus is divided into an outer and inner sinus by a thin vertical plate of bone. The outer sinuses are again subdivided into cells or pockets by incomplete transverse bony septa and terminate over the second premolar teeth in two pockets.

The inner sinus commences somewhat anterior to the outer. As it passes forward it becomes triangular in shape decreasing until it terminates in a point in advance of the first premolar. The right and left inner sinuses approach each other over the roof of the mouth until there is but a slight bony septum between them. The roof of the triangular portion of the inner sinuses is formed by a thin plate of bone which is also, in part, the floor of the nasal fossa. The floor of the inner sinuses is formed by a thin plate of bone which also forms the roof of the mouth. In the superior border of the dividing septum and at its posterior aspect, there is a large oval opening which allows free communication between the outer and inner sinuses.

The infraorbital canal of the ruminant is tube-like in form, somewhat flattened on one side; its posterior opening is in the anterior portion of the orbital space from which it passes forward on the superior border of the dividing septum between the outer and inner sinuses. It terminates in the infraorbital foramen just in advance of the premolar teeth.

In the horse, the ox, the hog, and all animals of this class the infraorbital canal passes through or along the floor of the maxillary sinus and is close to the roots of the teeth which receive blood supply and nerves from it, but when the infraorbital canal, as in man, passes along the floor of the orbit with the maxillary sinus intervening between the canal and the teeth, the teeth are supplied by the maxillo-alveolar nerve and vessels which enter the maxillary sinus a little above the tuberosity and pass forward in grooves along the lower portion of the outer wall of the sinus. The nerves are branches of the maxillary, and the vessels come from the internal maxillary. The incisor teeth, however, are developed in the buds forming the intermaxillary, incisive bone; thus it is more than likely they are supplied by other nerves and vessels than those going to the maxillary teeth.

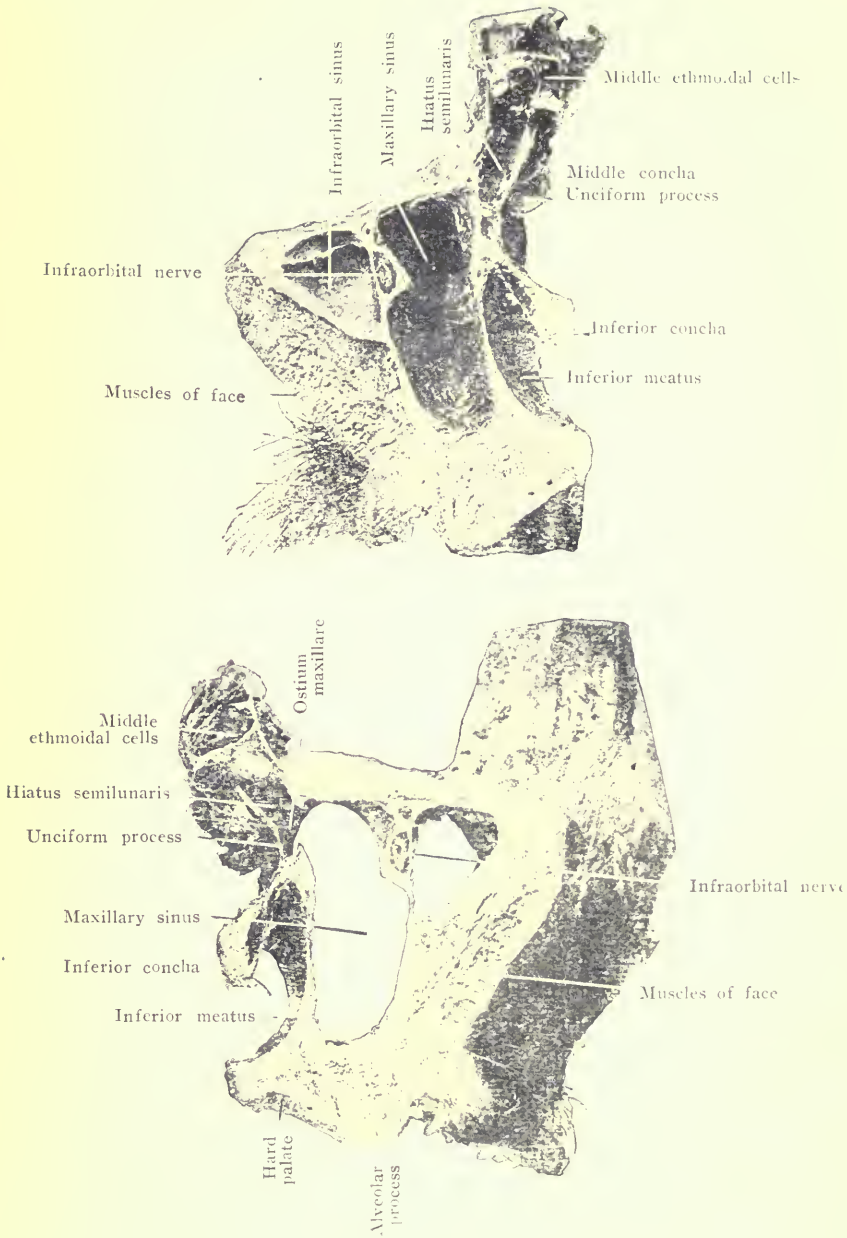


Fig. 7. Vertical transverse section of the upper jaw.

Fig. 8. Antero-posterior section through the maxillary sinus.

The Maxillary Sinus of the Horse.

The maxillary sinus of the horse, as its digestive tract indicates, is not so complicated as that of the ox; nevertheless its shape and relation to the teeth are very interesting. It commences under the orbit in two portions, the inner division being a little further back than the outer one. The inner wall of the inner sinus is formed to a great extent by the turbinated scrolls of the ethmoid and the turbinate bones. There is a dividing plate of bone separating the inner and outer sinuses with the infra-orbital canal or tube passing along its superior border; this construction is similar to that of the ox. It is along the upper portion of this tube that the inner and outer sinuses communicate with each other. The inner sinus is short, extending to an oblique plate of bone which commences at the turbinated scrolls and passes on through the external divisions of the

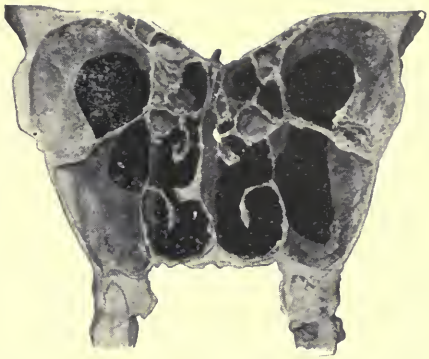


Fig. 9. Anterior view of a vertical transverse section from a skull of an old person, showing the thinness of the walls of the maxillary sinus, also membranous septa of the sinus.

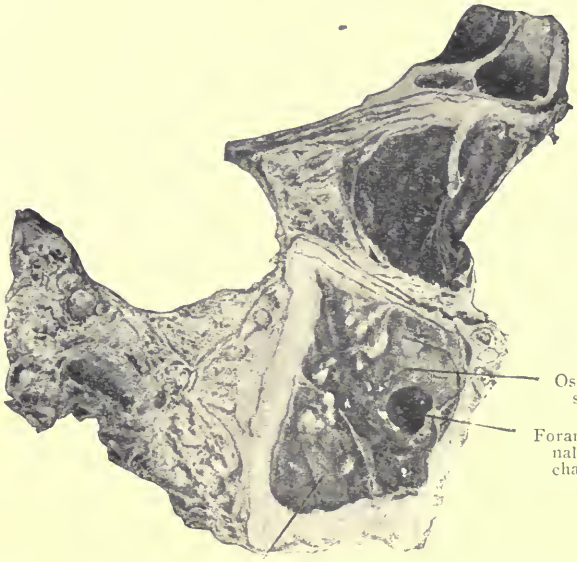


Fig. 10. A vertical antero-posterior section through the frontal sinus, orbit, and maxillary sinus showing a membranous septum of the sinus.

sinus to the marked prominence on the outer surface of the maxilla. This sinus does not pass forward over the roof of the mouth as in the ox, but terminates over the third molar tooth. This gives room for respiration through the nose which is necessary for the horse as it is impossible for him to carry on respiration through the mouth; in other words, he is not

a "mouth breather" such as is normal at times in the dog and in many other mammals, including man. The outer sinus commences in an oval-shaped pocket. As it extends forward it passes to the outer side of the three molar teeth, though in some cases it may not quite pass to the first molar.

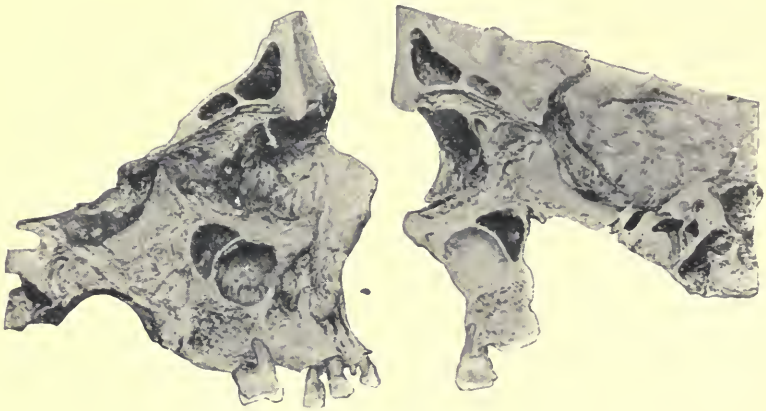


Fig. 11. Antero-posterior section through the center of the orbit, maxillary sinus and teeth, showing an enlarged cell of the orbital process of the palate bone. and a correspondingly small maxillary sinus.

The septum, of the inner and outer sinuses passes down until it comes near the tooth sockets where it divides into two portions, the inner one forming the inner wall of the sockets for the teeth, the outer portion crossing over and forming the ends of the sockets and then passing down along the roots of the teeth until it joins the outer wall of the maxillary sinus, leaving quite a space between the wall of the sockets of the teeth and the outer plate of the maxillary sinus; it also leaves a number of small pockets opposite the necks of the teeth.

There is very little cancellated bone surrounding the roots of the premolar and molar teeth but the arrangement of the thin plates of bone allows considerable elasticity.

The Maxillary Sinus of the Hog.

The maxillary sinus of the domestic hog is of simple form. It is situated principally over the molar teeth extending to the posterior part of the maxilla. An interesting point is that the roots of the premolar and molar teeth are not closely associated with the sinus, as the wide infra-

Fig. 12. A horizontal section of face cut just before the floor of the nasal cavity, showing absence of right maxillary sinus, and very small left sinus.

orbital canal passes between the roots of these teeth and the floor of the sinus. A bilateral transverse section of the face and jaws shows a domed roof to the sinus, the floor of which is elevated in the center, giving the sinus an arched shape. This arch-shaped character seems to exist for the purpose of giving room for the infraorbital canal or tube which passes antero-posteriorly under the floor of the sinus. It commences in the posterior portion of the maxilla and partly divides the maxillary sinus into two longitudinal portions, the outer portion being the larger. There is but slight space between the roots of the teeth and the canal, which is large in proportion to the size of the maxillary sinus.

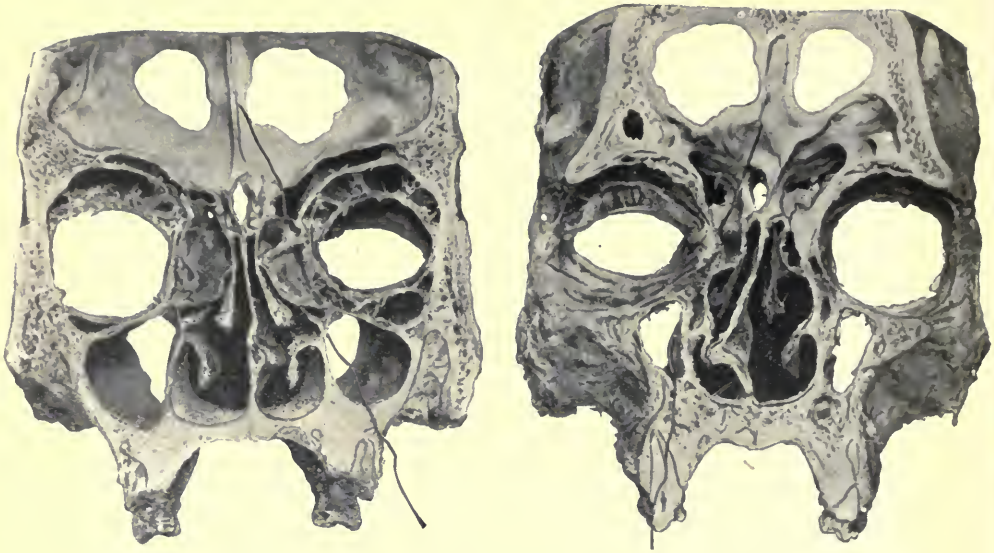


Fig. 13. Antero-posterior views of a vertical transverse section in the region between the second premolar and first molar teeth.

The Maxillary Sinus of the Wart Hog.

The maxillary sinus of the wart hog is much more complicated than that of the domestic hog. In a transverse vertical section cut a little posteriorly to the infraorbital foramen, the infraorbital canal is found resting just above the alveolar process with but little space between the canal and the roots of the teeth; the inner and outer walls of the canal join the inner and outer walls of the alveolar process without a line of demarcation. A large sinus is formed by the inner side of the wall of this canal and the double scroll-like inferior turbinate bone. This sinus extends posteriorly beyond the line of the teeth, where it is divided into two portions, anterior and posterior, with a thin septum. There is an ostium of communication between the two parts. These sinuses or cells, as said before, might be named the maxillo-turbinate, as they are placed between these bones.

The true maxillary sinus commences in two pockets above the third premolar tooth; the outer pocket is above the teeth and infraorbital canal. These two pockets extend posteriorly for a short distance until the septum dividing them terminates, throwing the two portions into one large maxillary sinus which extends backward, laterally and

Fig 14. Posterior view of a transverse section of skull cut in the region of the second premolar, showing large maxillary sinuses.

Fig. 15. Four vertical transverse sections of the upper jaw of a dog showing the absence of a true maxillary sinus.

Fig. 16. A vertical transverse section of the upper jaw of a cow cut in the region betwen the premolar and molar teeth.

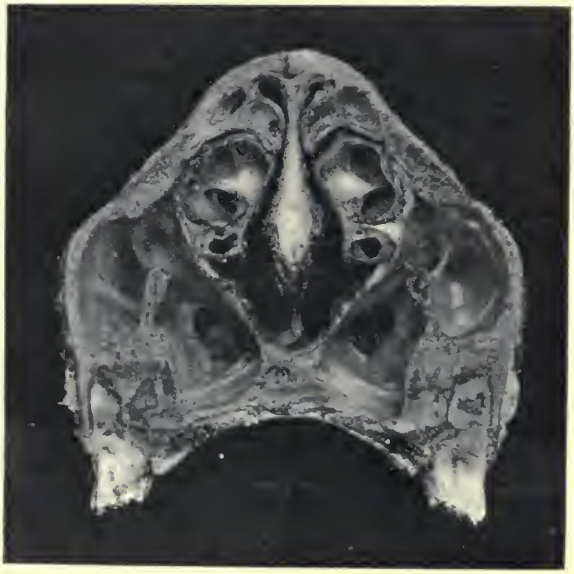


Fig. 17. A cross-section similar to Fig. 16, giving an anterior view with the soft tissue in position.

inwardly, terminating in quite a number of pockets divided by partial septa.

The hog family has a complicated frontal sinus which in some cases extends between the outer and inner plates of the bones over the entire brain case to the occipital bone.

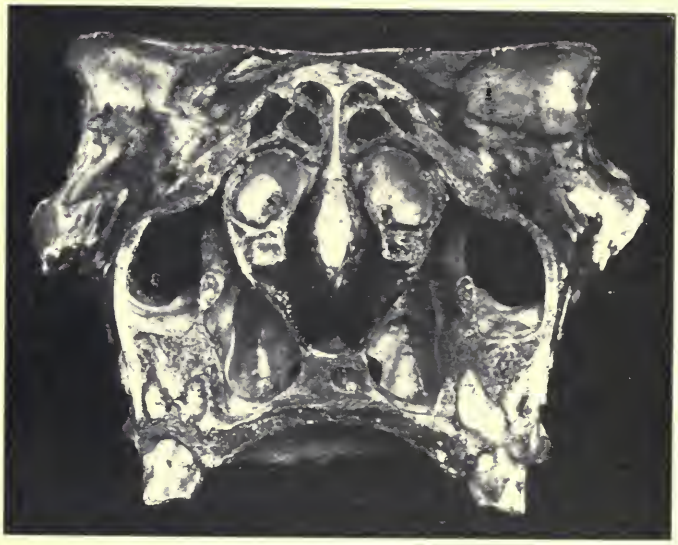


Fig. 18. Is made from the same skull as Fig. 17.

The Maxillary Sinus of the Carnivora.

The maxillary sinus of the carnivora varies in accordance with the kind of food upon which they live. Some of the bears subsist largely upon a vegetable diet and consequently have a fairly well-developed maxillary sinus, with the vertical plate of the palate bone forming a large part of the inner wall. On the other hand the true carnivora, such as the lion, that live entirely upon animal food, have no true maxillary sinus or bony box within the maxilla. There are, however, several shallow depressions upon the inner or nasal wall, covered by turbinated processes and membranes forming small cells, which might be named, as said before, maxillo-turbinate cells or sinuses. In this class of animals the infraorbital canal is usually very short and often of large diameter. This lack of the true maxillary sinus causes the nasal cavity to be wide in proportion to the size of the upper jaw and one might suppose that

this cavity would be open, giving free passage of air in respiration; but such is not the case, as the cavity is almost filled with the turbinate bones and scrolls, which give great power of olfaction, but very little room for respiration. All of these animals breathe through the mouth when using the least exertion.

Fig. 19. Is made from a side view of a cow.

Explanations of Illustrations.

We will endeavor to illustrate these points by photographic descriptions of the maxillary sinus of the various types of animals, taking up man first.

Fig. 1 is made from a vertical transverse section of a human skull of the civilized type of about twenty-five years of age, with apparently no pathological condition. The section of the maxillary sinus in this specimen is triangular in shape with its base under the orbit and its apex between the buccal and palatine roots of the first molar. There is a slight membranous septum in the floor of the sinus.

Fig. 2 gives a posterior view of the anterior section of the same skull as shown in Fig. 1. It will be noticed that on the left side the maxillary sinus passes down between the palatal and buccal roots of the first molar, having but a little shell of bone between the sinus and the roots. In the sinus of the horse almost a reverse condition may be seen, the maxillary sinus passing down on the outer side of the roots of the molar teeth and having but a thin plate of bone between the sinus and the outer side of the roots of the teeth (See Fig. 20). In the center of the floor of the right orbit of Fig. 2 the infraorbital canal with its contents is shown.

Fig. 20. Is a side view of a horse's skull, with a portion of the side of the face removed.

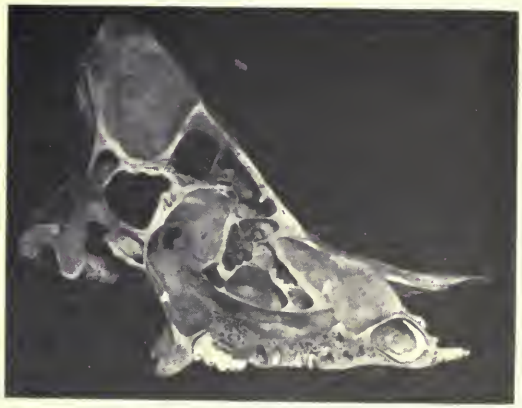


Fig 21. A side view of a domestic hog, with portion of bone removed.

Fig. 3 is an anterior view of a vertical transverse section of a lower type of human skull, showing a deep alveolar process.

The teeth are not so closely related to the maxillary sinus as in the more civilized races.

Fig. 4 is from a vertical transverse section of the face of a chimpanzee giving anterior and a posterior view of the nasal cavity and the maxillary sinuses. Anatomically speaking there is but little difference between the chimpanzee and man in this region except that in the former the parts lie more anteriorly in relation to the brain case.

Fig. 5 is from a sagittal section through the maxillary sinus of man. On the outer wall of the sinus, shown in the lower picture, the horizontal groove commences near the posterior portion of the sinus and extends forward to the anterior wall. It gives off branches going to the apices

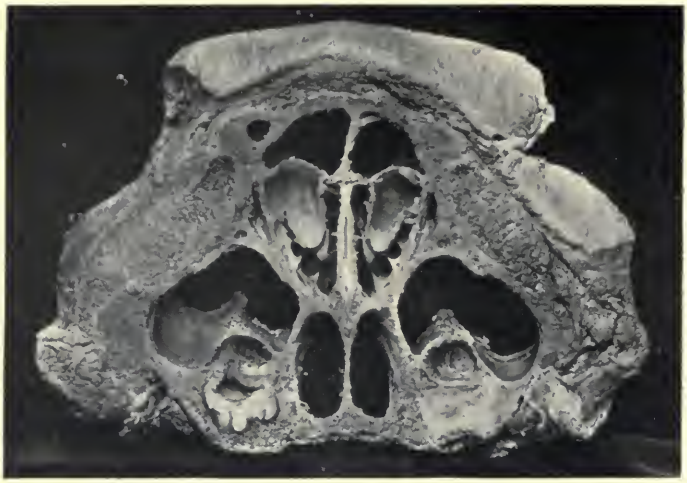


Fig. 22. A transverse section of the skull of a domestic hog. It shows a developing molar tooth and the infraorbital canal in the floor of the maxillary sinus.

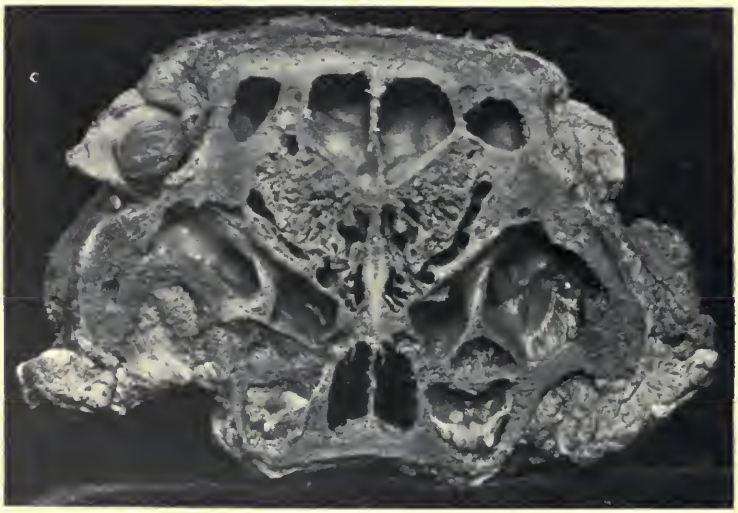


Fig. 23. Anterior view of the same skull as Fig. 22, looking toward the base.

Fig. 24. A posterior view of a transverse vertical section of the face of wart hog, cut a little posterior to the infraorbital foramen.

Fig. 25. Posterior view of a section of the same wart hog as shown in Fig. 24.

above the roots of the various teeth. This groove and its branches accommodate vessels and nerves of the teeth and the surrounding tissue; all the upper teeth except possibly the incisors are supplied by this superior alveolar artery. In the upper anterior corner of the sinus in the lower picture, the infraorbital canal passes downward and forward at an

Fig. 26. The adjoining section to Fig. 25.

angle of about 45° leaving a space or pocket—the infraorbital sinus or cell, which is virtually a rudimentary inner sinus normally found in the ox.

Fig. 6 is another sagittal section cut through the maxillary sinus, showing a typically shaped sinus with a pathological condition of the floor caused by a diseased tooth. It also shows the passage of the infraorbital canal diagonally across the anterior and upper angle of the sinus. The infraorbital sinus is similar to that shown in Fig. 5.

Fig. 7 is from a vertical transverse section of the left upper jaw, cut in the region of the ostium maxillare, giving an anterior and a posterior view of the maxillary sinus and its outlet into the middle nasal fossa. It also shows the anterior portion of the sinus divided into two by a vertical septum. Connected with this septum is the infraorbital canal, somewhat in the position to that found in some of the lower animals as the cow and horse.

Fig. 8 shows a slight bony partition or septum in the floor of the sinus.

Fig. 9 is from a transverse vertical section. The walls of the sinuses are very thin, showing that it is from an old person. There is also a large membranous septum in the right sinus. This septum, as is always the case, is incomplete, though some prominent investigators claim that there may be complete septa in the maxillary sinus.

Fig. 27. Is from the same skull as the last three illustrations.

Fig. 10 is a sagittal section, showing an almost complete anterior-posterior membranous septum. There are many small osteophytes on its surface; anterior-posterior septa are uncommon, claimed by some they do not exist.

Fig. 11 is a sagittal section through the center of the orbit, maxillary sinus, and teeth, showing an enlarged cell of the orbital process of the palate bone and a correspondingly small maxillary sinus. It is in cases of this character that this cell of the orbital process of the palate bone is sometimes taken for a separate part of the maxillary sinus.

Fig. 12 is a horizontal section made through the region of the maxillary sinus. The right maxillary sinus is very small and the left sinus absent.

Fig. 13, anterior and posterior views of a vertical transverse section in the region between the second premolar and the first molar teeth showing a wire passing from the frontal sinus into the maxillary sinus. The frontal sinus extended downward to nearly the level of the upper portion of the antrum. The maxillary sinuses are quite small.

Fig. 14, posterior view of transverse section of a skull cut in the region of the second premolar. It shows two large sinuses each of 35 c. c. capacity. These two maxillary sinuses extend very much below the level of the floor of the nasal fossa and approach each other closely over the

center of the roof of the mouth. At the point shown, the two sinuses are 19 mm. apart; opposite the canine teeth they are but 13 mm. apart. In the ox the left and right "inner" maxillary sinuses approach each other until there is but a slight bony septum between them.

Fig. 15 is from four vertical transverse sections of the upper jaw of a terrier dog showing the absence of a true maxillary sinus; there is a

Fig. 28. Saggital section of the lion's skull.

pocket on the nasal cavity of the maxilla. The inferior turbinate bone forms a covering to this pocket thus forming a maxillo-turbinate space or sinus.

Fig. 16 is a vertical transverse section of the upper jaw of a cow cut in the region between the premolar and molar teeth. The picture is a posterior view showing that each maxillary sinus is divided by a vertical plate of bone, into an "outer" and an "inner" sinus. In the dividing wall will be seen a cross-section of the infraorbital canal. At the point of intersection the inner sinus is triangular in shape, one side being the vertical plate, another, the bone forming the roof of the mouth, and the third wall of the triangle a thin portion of bone forming the floor of the nose. It will be noticed in the center of the section that the bone separating the sinuses is very thin. (See Fig. 16, a specimen of man showing the sinuses to be within 13 mm. of each other.)

Fig. 17, a cross-section, similar to Fig. 16, giving an anterior view with the soft tissue in position.

Fig. 18 is made from the same skull as Fig. 17, showing the posterior portion of the section looking backward with the soft tissue in place.

Fig. 29. Two pictures, the upper one that of a greyhound, the lower that of a badger.

Fig. 19 is made from a side view of a cow showing the outer maxillary sinus with the oval window leading to the inner maxillary sinus.

Fig. 20 is a side view of a horse's skull with a portion of the side of the face removed. It shows the relation of the roots of the teeth with the alveolar process and the maxillary sinuses.

Fig. 21, a side view of a domestic hog. The outer wall of the upper jaw and part of the teeth have been removed exposing the roots of the teeth, the infraorbital canal being immediately above them and below the maxillary sinuses.

Fig. 22 is a transverse section of the skull of a domestic hog. It shows the germ of a molar tooth with the infraorbital canal immediately above, and a dome-shaped upper wall above this; the maxillary sinus may be seen with its floor elevated in the center by the infraorbital canal. The teeth are supplied by vessels and nerves from the infraorbital canal.

Fig. 23 is an anterior view of the same skull as Fig. 22, looking toward the base. It gives a good view of the infraorbital canal and its relation to the teeth and the floor of the maxillary sinus. The canal shows

a tendency to divide the sinus into an outer and inner maxillary sinus, somewhat like that of the ox, as it partially does in the upper anterior portion of the maxillary sinus of man.

Fig. 24 is a posterior view of a transverse vertical section of a wart hog, cut a little posteriorly to the infraorbital foramen and through the first molar teeth. It shows the infraorbital canal above the roots of the

Fig. 30. Sagittal section of a human skull.

teeth. The true maxillary sinus is not shown at this point, but the double-scroll inferior turbinate bone closes over the depression in the nasal wall and forms maxillo-turbinate cells or sinuses.

Fig. 25 is a posterior view of a section of the same wart hog as shown in Fig. 24, cut through the second molar teeth. The infraorbital canal is immediately above the sockets of the teeth.. The two outer pockets on each side near the canal is the anterior portion of the maxillary sinus. The larger pocket on each side is the maxillo-turbinate cell. The spaces in the upper central portion are the commencement of the frontal sinuses.

Fig. 26 is the adjoining section to Fig. 25, an anterior view showing conditions very similar to the last figure. The canal, the two portions of the maxillary sinus, the termination of the maxillo-turbinate cell and frontal sinuses are shown.

Fig. 27 is from the same skull as the last three illustrations. The infraorbital canal is shown. The two maxillary sinuses of each side have united to make a large flattened-out sinus which will be seen again as we pass posteriorly or upwards: here we find the sinuses again subdivided by many septa.

Fig. 28 is a sagittal section of the lion's skull giving lateral view of the nasal cavity showing no true maxillary sinus.

Fig. 29, two sagittal sections, the upper one that of a greyhound, the lower one that of a badger. These sagittal sections show the brain case, and the outer wall of the nasal cavities, with slight depressions, and when covered by the concha and ethmoid bones, forming a maxillo-turbinate sinus. The apices of the roots of some of the teeth in the badger are seen in the floor of the nasal cavity.

Fig. 30 is from a sagittal section of a human skull showing no true maxillary sinus. The apices of the roots of the molar teeth are seen in the floor of the nasal cavity similar to the condition in the badger, Fig. 29.

The Rational Treatment of Chronic Empyema of the Maxillary Sinus.

By Dr. A. T. Rasmussen, La Crosse, Wis.

Of all the intra-mural sinuses, the maxillary, or antrum of Highmore, as it is sometimes called, is by far the largest and also from the standpoint of the dental or oral surgeon the most important. The most important, because it is more liable to be the seat of infection than any of the others. This great liability to infection is due to the floor of the sinus being in such close proximity to the roots of the molars and bicuspid teeth. In case of an alveolar abscess of the upper molar, or bicuspid teeth, there is great danger of the pus breaking through the thin, bony wall separating it from the sinus.

Anatomy of Antral Sinus.

Study for a moment with me the anatomy of this sinus, and we find that it is, roughly speaking, a pyramidal shaped cavity, with its base or inner wall toward the nasal cavity, and its apex pointing toward the malar prominence. It is spoken of as having a base, apex, roof, floor, anterior and posterior walls. The bones which go to form the boundaries of this cavity are the superior maxillary, palate, malar and inferior turbinate.

The normal opening to the maxillary sinus is through its inner wall, near the roof of the sinus, and opening into the middle meatus of the nasal cavity. The inner wall is thin and formed by the perpendicular plate of the palate bone and the inferior turbinate. The floor of the cavity is usually quite irregular, due to the roots of teeth projecting up into the sinus, being covered only by a very thin, bony wall, the lower parts of which are usually somewhat lower than the floor of the nasal cavity. The outer, or anterior wall, is also quite thin, especially in the region of the canine fossa, as is also the roof, which is formed by the orbital plate of the maxillary bone. Very often the sinus is partially divided by thin, bony partitions.

The whole antrum is lined by delicate mucous membrane.

Symptoms of Antral Empyema.

Keeping in mind, then, the anatomy of the sinus, and its relation to the surrounding structures, let us see what the conditions are when a patient presents suffering with a chronic empyema of the sinus. We have the mucous membrane, lining the sinus, constantly bathed in pus which has no way of escape except through the ostium-maxillare, which we have seen is situated near the top of the cavity. Thus, with the patient in an upright position the greater part of the time, the sinus must fill up to the level of this opening before the pus will run over into the nasal cavity. There may be more or less necrosed bone. The mucous membrane is thickened and flabby, or the sinus may be partially or entirely filled with polypi.

The original infection may enter through the *ostium-maxillare* from the nasal cavity. It may be a secondary infection from some of the other sinuses. However, in the great majority of cases, I believe, it is caused by one or more abscesses at the apices of the roots of teeth breaking through the thin, bony floor of the sinus. The molars, bicuspids and occasionally the cuspids are the most frequent offenders in this respect, although an alveolar abscess from any tooth may find its way into the sinus. Ballenger estimates that nearly one-half of the cases are of dental origin. Tilley, of London, reports that "of three hundred cases of antral disease seen by him, only one had sound teeth." (Ballenger.) Clinical experience, supported by such statements as the above, leads me to say without reserve that I believe by far the greater number of cases are of dental origin. However, it is not within the scope of this paper to discuss the etiology of this condition.

Diagnostic Examination.

After having learned the history of the case from the patient, the surgeon should proceed to locate, if possible, the real and original cause of the trouble. For this purpose trans-illumination of the parts is sometimes and often very helpful. A good radiograph is indispensable. By means of it we can usually determine whether or not the roots of teeth are involved, and whether or not such teeth can be treated and saved. We can also, to some extent at least, see whether there is an infection of some of the other intra-mural sinuses. The nasal cavity should be carefully examined to see if there is any obstruction to free ventilation and drainage of any of the sinuses, due to adenoids, hypertrophied turbinates, deflected septum, etc.

A diagnosis of chronic empyema having been established, clinical experience has shown that we cannot hope for any treatment short of a radical operation to effect a cure.

For lack of time we cannot discuss the merits and shortcomings of the different methods of operating that have been and are being advocated, but will proceed to describe what seems to be the most rational method of procedure and the one which has proven to be clinically correct.

Technique of Operation in Antral Sinus.

The patient is prepared for and given a general anesthetic, preferably ether, unless contra-indicated by pulmonary lesions, or other complications, which would bar the use of this drug. Deep anesthesia is necessary for the operation that is to follow, and the anesthetic, whatever it may be, should be administered by a competent anesthetist, by some means whereby the patient may be kept in a state of even and deep anesthesia.

The mouth, having been previously cleansed, is now opened and held by a suitable mouth gag. The tongue is grasped with a small non-crushing tong forceps and drawn forward; the oral cavity cleared of mucus and made as nearly aseptic as possible, and we are ready to open the sinus.

With suitable retractors the lip and cheek are raised, exposing to view the mucous membrane over the canine fossa of the superior maxillary bone. An incision is made through the muco-periosteum by placing the knife at a point just above or slightly posterior of the second molar tooth, at the bucco-gingival junction, then drawing the knife downward and forward to a point slightly below the apices of the first molar roots; then forward and upward over the apex of the cuspid root. Thus we have a crescent shaped incision, with its convexity downwards, which permits of the muco-periosteum being raised, exposing the entire outer wall of the antrum. The muco-periosteum is then dissected from the bone and held back with suitable retractors. Hemorrhage is checked with hemostatic forceps and hot sponges. The outer wall of the sinus is now broken down with chisel and mallet and Rongeur forceps, or a surgical bur may be used for this purpose. The opening is made large enough to fairly expose the interior of the cavity and admit the finger being passed into all parts of the cavity large enough to permit it. With suitably sized and shaped instruments the interior of the sinus is now thoroughly curetted, exploring all parts inaccessible to the finger by means of probes to insure thoroughness of curettement, removing all necrosed bone, flabby granulations, or polypi. If there are any bony septa, they are broken down and the interior smoothed with a curette. If the roots of any of the teeth are involved, and the same are beyond all possibility of saving, these should be removed; but only where they cannot be saved must this be done. If, however, there is enough bony tissue left around such teeth or roots to support them, the ends of the

roots projecting into the abscess cavity are resected, or one whole root may be removed in the case of a molar tooth. If the alveolar process is healthy, it is surprising how much of the root may be cut away and the tooth still remain useful and healthy indefinitely.

Amputation of Projecting Root-Ends.

The resection of such roots is most easily done by drilling a hole through the root at the point of resection, enlarging this opening, and with a fissure bur cutting the end off and smoothing the edges. This should be done with as many of the teeth as may be necessary. While it is preferable that such roots be filled before resection, it is not always possible, and the ends being exposed to view after the operation, the canals may be filled later, the ends of the gutta-percha points being smoothed and the canal sealed by means of a hot burnisher.

Post-Operative Treatment.

The edges of the bone are now smoothed with curettes or surgical bur. It is very desirable that this last point be not overlooked, inasmuch as Nature will heal the wound much more readily than if left rough. The sinus is now cleared of blood as nearly as possible, and the entire cavity firmly packed with iodoform gauze. Some men advocate the use of compound tincture of benzoin as a packing, either alone or in combination with iodoform in bone cavities. Personally I have never been able to see any advantage in this. The packing is renewed in 24 to 48 hours, and as often as may be necessary thereafter, until healthy granulation tissue covers the interior of the cavity, irrigating the wound each time the packing is changed. It is sometimes desirable to continue the packing of the interior of the wound while Nature is closing the opening, in order to prevent the falling in of the outer wall of the antrum; in other words, for cosmetic purposes. Of course this packing is discontinued when the opening becomes small enough, so that there is no further danger of disfigurement.

If there are any contributing causes which would be liable to prevent, or even retard recovery, such as infection of any of the other sinuses, nasal stenosis, from whatever cause, or any abnormal condition which prevents proper ventilation of any of the sinuses, the correction of the same must be included in the operation.

The time allotted to this paper is too short, however, to allow me to enter into a discussion of the method of operation for these complications, although they are quite frequently present, and it is of the utmost importance that the surgeon should recognize and properly treat them when they do exist.

Advantages of Operation.

In considering now very briefly the advantages of this operation, remember that there are three sides of the sinus from which it may be entered, namely, the floor, the nasal or inner wall, and the outer or buccal wall. The advantages of this method over any other with which I am acquainted are, first: while the oral cavity cannot be made surgically clean, thereby giving us a sterile field of operation, we can more nearly approach this ideal here than is possible in the nasal cavity. Second, the field of operation is more clearly in view of the operator than is the case if employing the nasal route. Third, the finger may be passed into the sinus, thereby revealing to the operator through the sense of touch what he is unable to see, no matter which method he may employ. Fourth, hemorrhage is more easily controlled than if operating through the nose. Fifth, remembering that the floor of the sinus is usually lower than that of the nasal cavity, it is possible to extend the opening to the lowest point of the antral cavity, thereby establishing perfect drainage. This cannot be accomplished by breaking down the nasal wall. This is absolutely important. Thoroughness of operation, including drainage, is the password to success in treating these cases. Who would attempt to drain the water from a barrel by making an opening near the top, or anywhere else, except at the lowest point? The same principle applies when draining the maxillary sinus. Get the opening to the lowest point. It is the rational way and clinically correct. Sixth, the post-operative treatment is facilitated by having the opening where the interior of the sinus can be more easily examined, cleansed and packed, while if exuberant, flabby granulations occur, they can be cauterized with silver nitrate or other caustic. This would be almost if not entirely impossible were the opening from the nasal cavity. Seventh, there have been no important structures sacrificed. The nasal wall is intact. This is important. In describing the intra-nasal method of operating for this trouble, Ballenger says: "Clinical experience has shown that a small opening in the naso-antral wall quickly closes, whereas a large one remains open permanently." That statement by as eminent a man as Dr. Ballenger is enough to condemn that method of operating. The naso-antral wall was placed there for a purpose. It behooves the surgeon not to needlessly sacrifice it. No teeth have been sacrificed. This is a great advantage over any method whereby one or more teeth are removed for gaining entrance to or draining the sinus. Again let me say with all the power at my command, that it is absolutely wrong to *sacrifice* any teeth in the treatment of maxillary sinusitis, either acute or chronic. Eighth, when the patient is dismissed no function has been interfered with and the esthetic has

not been marred. These are two important considerations to be taken into account in all surgery, especially that of the head. As specialists in oral surgery, our patients have a right to demand of us that we be in the very front ranks of the advance-guard of esthetic surgeons. Ninth, barring malignancy and infection of some of the other sinuses, and siphilis, the patient will get well, and that, within a reasonably short time. There will be no need for a permanent opening or continued treatment for years, nor will the patient's health be undermined by a continuous discharge of pus into the nasal or buccal cavity to be swallowed and absorbed into the system. In my experience of twelve years in using this method of operating, covering a varied lot of cases, ranging in their history from those of recent origin to at least one of over thirty-five years' standing, I have never seen a case which failed to respond satisfactorily to the treatment as outlined, barring, of course, the causes mentioned above.

We have considered what I believe has been shown to be the most rational method of treating a serious and often very stubborn malady. Now let me make a plea for the performance of this operation by the oral specialist. The oral cavity and adjacent parts is the particular field of the human body, the treatment of which he has elected to specialize in, as apart from the general surgeon; therefore, he should be better equipped to perform this and similar operations than is the man who divides his energy to the extent of treating a larger portion of, or perhaps, the entire body. The man who sees a case only occasionally, of course, cannot be in a position to treat such a case as successfully as the man who sees many and who devotes his time largely or entirely to the treatment of oral lesions; therefore, when you meet with a case of this kind (and let me say, by way of parenthesis, be on the lookout for them, for they are much more common than generally supposed and responsible for many troubles not generally recognized as such), unless you are prepared to treat the case yourself, you should refer your patient to an oral surgeon. By so doing you will not only add to the welfare of your patient, but at the same time add to the dignity and high standing of your own profession. This operation, and others about the oral cavity, should be done by the oral surgeon.

Surgical Treatment of the Antrum of Highmore.

By Adolph Baer, B.L., B.S., D.D.S., M.D., San Francisco, Cal.

When in 1651 Highmore observed the free flow of pus following the extraction of an upper molar tooth, and found that he could enter a cavity in the superior maxillary bone, the first opening of the maxillary antrum was recorded.

First Surgical Entrance of Central Sinus.

Fifty years later Cowper, an English surgeon, put into effect what he remembered of Highmore's work. He had a patient with a toothache and pus flowing from one side of the nose. He extracted the first upper molar tooth, but found on attempting to enter the sinus that the alveolus was intact. So he bored a hole upward through the alveolar process and opened artificially into the antrum of Highmore, thus performing the first known operation upon the maxillary antrum. Highmore found by accident that it could be done; whereas Cowper did it intentionally.

One hundred and seventy years later Ziem operated upon and reported twenty-five cases by Cowper's method, thus making the opening of the antrum of Highmore a definite surgical procedure.

In 1743 Lamoirier opened into the antrum through the canine fossa to liberate a discharge of pus coming from one side of the nose, but having no relationship to aching teeth. In 1768 Bodenave, and in 1798 Desault, reported a similar procedure, while Kuster just one hundred years later, in 1890, described the operation in detail and established this method as a definite surgical procedure under his own name. And then Krause, and later Mikulicz, working through the nose, broke down the naso-antral wall and established a large drainage opening from the antrum into the nose, subsequent irrigations being made through the nose.

In 1893 Caldwell was the first to combine the Kuster operation with the Krause-Mikulicz operation, making an opening through the canine fossa and then working through the antrum, opened into the nose and called the combined procedure the Caldwell operation.

He was followed by Gerber in 1893; Baenninghaus in 1896; Luc in

1897; Maure in 1899; Cermoyez in 1902; Killian in 1904; Denker in 1905; and Tilly in 1906; each putting forth a claim to originality by adding modifications to the Caldwell operation.

When to open the antrum into the nose; when to open from the nose into the antrum; whether to curette or not, and the extent of the curettage; whether to pack or not to pack; how much of the lower turbinate should we sacrifice, or should we sacrifice any at all; whether or not to turn down a flap into the antrum; whether to make a large or a small opening connecting the nose and the antrum; to suture the wound into the mouth or not; whether or not to irrigate the antral cavity after removing the packing, if packing has been used—these are some of the problems discussed and decided by these different men with the addition of a different modification in each case.

Ten years ago I dreaded seeing an antrum case come into the office. To-day the subject has more or less lost its interest for me because it has ceased to be a problem. I have adopted the Denker modification of the Caldwell operation, and after having treated well over two hundred cases, I am willing to back up my belief with the statement that the Denker operation will cure every case of antrum disease when every other method of treatment has failed. It is of course best, in the treatment of each individual case, to try the numerous other simple procedures first before attempting the Denker operation.

Method of Procedure in the Treatment of an Antrum Case.

The first few days of an acute antral suppuration must be treated without surgical interference. Cocain, 20 per cent., and adrenalin, 1-1000, should be applied twice daily beneath the anterior end of the middle turbinate bone, and four daily doses of asperin, 10 gr., and caffein, 1 gr., should be given internally; and in the interval between the local applications a spray of methol, adrenalin and albolene should be used every two hours to prolong the effect of the cocain.

At the end of about one or two weeks our first surgical step is taken. The anterior end of the middle turbinate is resected, to permit freer drainage through the normal antral opening (for the swollen and turgescent turbinate closes off this opening) and the antrum is irrigated daily by means of a straight Mikulicz needle. This needle is introduced into the antrum, beneath the lower turbinate bone, passing through the naso-antral wall where it is thinnest, *i. e.*, high up beneath the turbinate and about one-half inch internal to its anterior border. This procedure although very simple, must be done carefully to prevent the needle from

passing through the roof of the antrum and on into the orbit. The consequences of such a mishap are serious, and it is not an unusual occurrence. In acute cases, from three to six irrigations, using either normal salt solution or bicarbonate of soda, will be sufficient to cure the condition in most instances.

When this procedure has been carefully carried out without result, and in those cases where the antrum is free from granulation and polypoid formation, and especially when the pus discharge is of a rusty, straw color and free from odor, it is usually possible to successfully operate by the intra-nasal route. The operation in brief is as follows:

Technique of Operation in Antral Sinus

After cocainizing the inferior turbinate and the anterior 1½ inches of the inferior meatus of the nose, the anterior third of the inferior turbinate bone is resected. An opening is then made through the naso-intral wall with a large trocar, a chisel or a drill. Using this hole as a starting point, as much of the naso-antral wall as possible is removed with a punch forceps, preferably the Wagner, Brunning or Hajek. This leaves a large and sometimes a permanent opening, through which it is possible to drain and irrigate the antrum.

This, the so-called Krause-Mikulicz operation, has many advocates, and is very often successful. It has been modified and I think improved by Canfield and Hallé, so as to include the anterior naso-antral angle.

But this operation will always fail under certain conditions, and those conditions are:

Foul smelling, thick, white creamy pus discharge; presence of granulations or polypoid formation within the antrum; necrosis of any part of the bony wall of Highmore's cavity. And under these conditions, when the case has passed over from an acute to a chronic stage, where radical surgical interference becomes necessary and is consented to by the patient, the radical Denker operation becomes the operation of choice and is to be preferred to all others. (I say consented to by the patient, for while one patient will prefer to undergo a long course of treatment, rather than submit to an operation, another finds the constant, repeated treatment, with the greater certainty of failure, intolerable, and will prefer the quicker and surer results following operation.)

In the Denker operation the anterior opening gives us a clear and open view into all angles and corners and irregularities of the antrum for whatever work may be necessary; and the internal or nasal opening, after Denker, establishes a permanent opening into the nose for drainage which cannot be obtained by any other method.

The operation can be done under local anesthetic, but in my opinion a general anesthetic is to be preferred.

Denker Operation. The upper lip and angle of the mouth are drawn upward and outward, widely exposing the upper teeth and gums. A long incision is made one-half inch above the gingival margin, beginning in the mesial line and extending outward about one and one-half inches. The internal or mesial end of the incision is joined by a second perpendicular incision about one-half inch long and extending upward to the inferior margin of the nasal orifice. This gives us an incision with a long horizontal arm and a short perpendicular arm in the median line of the mouth. The incision is made down to and through the periosteum. The mucosa is then elevated so as to expose the entire anterior wall of the antrum, extending internally so as to expose the anterior external margin of the nasal orifice. With a Hajek elevatorium, the mucous membrane is then freed from the nasal opening and elevated from the naso-antral wall as far back as possible, *i. e.,* a distance of about one inch to an inch and a quarter.

With the oral mucosa elevated and held up by a retractor, a chisel or trephine opening is made into the antrum. The opening is enlarged by means of Rengier forceps: inward to the anterior naso-antral angle, upward a distance of about one inch and downward it is leveled to the floor of the antrum with a chisel or drill.

All the bone thus far removed is rather thin. Starting now at the naso-antral angle, the naso-antral wall is removed for a distance of about one inch, leaving only the naso-antral mucosa separating the nose from the antrum. Using a strong headlight, the entire interior of the antrum is now inspected, probed and cleansed. Polypi are removed with curette and forceps. Carious bone is curetted or chiseled or Rengiered out. If a carious tooth is found projecting into the antrum, it should now be removed to prevent reinfection. The greatest care must be exercised in thoroughly removing all polypi from the floor and the internal wall, especially at its anterior and posterior angles, and the ridge of bone separating the nose from the antrum must be lowered to the floor of the antrum. This opening can be enlarged from the antral side.

An inverted U-shaped flap is then turned down from the nasal mucosa into and onto the floor of the antrum, and a continuous floor is thus made for the combined antrum and lower meatus of the nose.

The entire cavity is washed with peroxide, swabbed with iodine, sponged dry and packed with iodoform gauze, the flap being carefully held in position while the packing is being introduced. The end of the packing is left protruding into the mouth. The mouth incision is then closed with sutures, and the end of the packing is allowed to project into the mouth between any two sutures. One-half the packing is removed on

the fourth day, one-half of what is left is removed on the sixth day, and the remainder is taken out on the eighth day. The packing is taken out on the mouth side because this can be done without interfering with the nasal flap and once removed no further packing is resorted to.

The two most important steps in the operation are:

1. Thoroughly clean the antrum during the operation.

2. Make the naso-antral opening as large as possible, and fasten the flap of nasal mucosa so that the opening into the nose cannot close.

Causes of Failure.

Failure to obtain complete healing after the Denker operation is always due to one of three causes:

1. *Bad Operation.* The antrum is not thoroughly cleaned of polypoid mucosa or necrotic bone; or there is not a big enough opening made into the nose; or the nasal flap onto the floor of the nose is not made right.

2. *Mistake in Diagnosis.* We must take sufficient time to make a correct diagnosis and be sure before the operation that we are dealing with a straight antral suppuration, and that the frontal, ethmoidal or sphenoidal sinuses are not coincidentally involved. If they are, they must first be treated and cured before we can hope to cure the antral suppuration.

3. And here is the only "if." We try to avoid operation in cases of ozena. We do not do more than is absolutely necessary in cases of ozena. Ozena spells a badly healing constitution, for it usually means siphilis.

And after the operation we do not douche the cavity or do any after-treatment. The patient can, if necessary, be discharged on the day the last piece of packing is removed. There is no after-treatment, no washing, no irrigation, no probing, no anything. The average length of time for complete healing is from three to four weeks.

We must, of course, remember this: If during the first six months or year after operation the patient catches cold, *i. e.*, gets an acute rhinitis, he may get a serious discharge from his antrum. But the discharge will take place through the opening which we have made, and will clear up without any treatment just as soon as the acute rhinitis clears up. If a normal man can catch cold in a healthy antrum, it is not surprising that a patient thus operated on can catch cold likewise.

A Compound Cementoma.

By Benj. Goldstein, L.D.S., R.C.S., Edin, Johannesburg, Transvaal, South Africa.

The patient, a miner, about thirty-five years, presented with the following history: For years he had suffered from tinnitus, affecting the right ear; also neuralgia on right side of head extending over the right aspect of the scalp toward the occipital region. During the last six months the patient had been under treatment by an aural specialist for his tinnitus, but with no appreciable result. Thinking that the cause of the tinnitus and facial neuralgia might be due to some dental trouble, the patient was referred to his dentist, who removed some superficial carious matter from the occlusal aspect of the second right upper molar and inserted an amalgam filling in the cavity thus excavated. The neuralgic symptoms, however, instead of improving became worse, and when brought under my notice the patient was in a rather exhausted state owing to loss of sleep, etc.

After the patient had recounted his symptoms, I examined the mouth for the cause of this tinnitus and neuralgia, as I was convinced that a dental affection was the cause of the trouble. On examining the parts about the right second upper molar it was noticed that there was a bulging of the alveolus on the buccal aspect, not to any great extent, however. Be it understood that no complaint was made by the patient as to pain in the tooth or immediate surroundings. On careful examination one noticed what at first sight appeared to be a splinter of alveolus next to the mesial aspect of the tooth, but with the aid of the probe it was ascertained that this was firmly attached to the tooth, and on further exploration a large osseous body (which resembled cementum when the probe was worked backwards and forwards over it) was discovered. I at once decided to extract the tooth, feeling sure I had discovered the primary cause of the tinnitus. Novocain solution was injected.

Some ten minutes' hard work ensued ere the tooth showed the slightest attempt at loosening. The forceps then made way for the elevator, which completed a very difficult extraction. On examination of the tooth the following points were noticed:

The tumor, slightly larger than the crown of the molar, was attached to the tooth mainly on the buccal and mesial aspects and appeared to be composed of cementum. Though by a cursory survey the crown appeared to be involved, on closer examination it was discovered that there was a distinct separation between crown and tumor, the attachment of the latter to the tooth being from the junction of the crown with the buccal roots, the latter being almost wholly incorporated in the tumor. The palatine root was quite normal and free from the tumor.

There are really four roots showing; the mesio-buccal root and the extra root having been crowded backwards toward the disto-buccal root by the encroachment of the tumor.

It is evident that the tumor had been in existence for quite a number of years.

The patient bore the ordeal of extraction very well, considering the nature of the operation. The resultant socket was of most alarming proportions, being about the size of a walnut. This was packed with aseptic gauze, the gauze being renewed every other day until healthy granulation had formed.

The tinnitus and neuralgia lasted for about a week after the extraction of the tooth, and then disappeared entirely, much to the patient's relief.

Etiology and Treatment of Oral Tumors.

By Fulton Risdon, M.B., D.D.S., L.D.S., Toronto, Can.

I may say at the outset, that the title of this paper suggests all oral tumors, and in this respect it is misleading as it is my intention to discuss the etiology and treatment of carcinoma, sarcoma, fibroma and epulis. My purpose is to treat the above subject as practically as possible, giving only the etiology which is accepted generally and of value clinically. Also in regard to treatment, a full but concise outline of the same will be given.

Carcinoma, Etiology.

Cancer is thought to be due to chronic irritation, dental or mechanical, smoking, extension from the cheeks or lips or metastatic origin. As statistics show that carcinoma is four times more frequent with men than women, would it be fair to say that smoking may have at least a predisposing effect?

Treatment.

Early diagnosis is the first step in the treatment and nothing should be left undone which would aid in arriving at a conclusion. The first step is to remove a section from the growing margin of the tumor for pathological examination. When the diagnosis of carcinoma is made, one must be most guarded against giving that unwarranted exhilarating ray of hope or too cheerful a prognosis. Seldom is the surgeon justified in dealing with this dreaded disease unless he remove the entire field, including a clear area encircling the growth. Free removal with the minimum disfiguration is the rule. The charge has been made that the surgeon in this country is too readily satisfied in these advanced cases with having the patient returned to bed alive, knowing the immediate high mortality, and that he neglects to remove as extensively as is imperative. If the case is well advanced, nothing short of total excision of the upper jaw and a thorough search into the various sinuses should be considered. Partial excision in certain well selected cases in the upper jaw may be undertaken with reasonable safety, but in the lower jaw an exarticulation or resecting is the procedure promising the best results. It has been the practice to resect the

glands on both sides of the mandible in carcinoma. Seldom is a cure effected and on this account every case should have a subsequent treatment of Röentgen rays or radium. There is no doubt that the Röentgen rays retard the growth, at least for a time, and that radium in some cases completely alters the microscopic appearance of the neoplastic tissue.

Sarcoma.

The importance attached to injury as an etiological factor is still in doubt, but is receiving greater attention. In all text books series of cases are reported giving a history of acute trauma, some as high as twenty-three per cent. I have had two cases come under my observation where trauma seemed to have had some influence. One was a young girl of seventeen who on May 26, 1913, fell from a hammock and injured the upper portion of her tibia. On June 16th she was operated on for ostitis with little or no improvement. On October 24th, the leg was removed, a diagnosis of sarcoma having been made.

Treatment.

Here again early diagnosis is imperative and to aid this a section must be removed. The pathological report here is of greatest value, as upon this report depends not only the prognosis but also the decision as to the extent of the operation. If round-celled or melanotic sarcoma is found, the treatment must be most radical, but if giant-celled or fibro-sarcoma, the prognosis is more favorable and a less mutilating operation may suffice. These cases are never to be considered cured until after five years, and up to that time must be watched for recurrence. With this form of growth metastasis takes place to other parts sometimes very early. One meets many border-line cases in surgical practice but a safe rule is, if the growth is increasing slowly and the skin not involved it is generally considered safe to operate; but if rapidly growing and ill-defined the skin involved, the orbit invaded and glands enlarged, it is not likely that the patient will receive any benefit from the operation. In these cases, it is plainly the duty of the surgeon to be frank and to advise the use of Röentgen rays, serums or radium. The glands in sarcoma are rarely involved but where palpable should be removed. It is now considered that in giant-celled sarcoma bridges of bone may be left in most cases to maintain the contour of the face. In early cases, radium is considered a specific according to a report by Dr. Abbe in the *Medical Record* of March 15, 1913. Here again as in carcinoma, all cases should receive subsequent care. Röentgen ray or radium treatment, the latter to my mind to be preferred.

Fibroma, Etiology.

The etiology of fibroma is unknown, but Broca is of the opinion that fibroma arises from displaced tooth-buds. Mimmer and Blauel think they arise from the connective tissue of blood-vessels or from the periosteum of the jaws. There are two varieties—periosteal and central—the names clearly indicating the location of each.

Treatment.

Fibroma, strictly speaking are rare, so must be viewed with suspicion, as in sarcoma one finds considerable fibrous tissue. As to operative treatment, the removal should be complete, but in all cases not too far advanced, bridges of bone can safely be left; still we should be thorough as recurrences are frequently malignant.

Epulis.

Epulis is frequently spoken of as sarcoma but this is no doubt due to an error in diagnosis. The words "sarcoma" and "epulis" must in the near future mean on the one hand malignancy, and the other, benignancy; still one must remember that as a tumor it lies midway between inflammation and new growth.

As to the etiology, local causes must receive consideration, such as infection around retained roots and trauma. It originates from the periosteum of the alveolus or tooth socket, or from the connective tissue underlying the mucous membrane. The giant-celled epulis is more likely to be found associated with infected roots than the fibrous type and these on the other hand may arise from around apparently normal roots.

Treatment.

In the treatment of epulis, the prognosis is always favorable after early and radical operation. That is to say, in all cases a portion of the alveolus must be removed at the time of the operation, always bearing in mind that recurrences are likely to be malignant. Further, the operation for the fibrous epulis is less radical than for the giant-celled variety.

In the case of the fibrous epulis, it seems sufficient to excise the growth and cauterize the base with the actual cautery, but it is best to keep the case under observation for some time subsequently. In the case of the giant-celled epulis, the operator will likely be compelled to remove a tooth on each side of the growth as well as a section of the process. Metastasis seldom or never occurs.

Radium.

Radium as a curative agent is receiving considerable attention at present and some prominent men claim that it will suffice for the eradication of epulis. In *Medical Record* of March, 1913, Dr. R. Abbe of New York recommends it for the giant-celled variety of epulis, without any further

operative treatment. He says—"Thorough surgery is still the supreme reliance in eradication of malignant disease of the mouth, and early resort to it is the patient's chief hope of cure. Still radium has many interesting conquests in this field but in advanced cases of cancer its good is transient—in giant-cell sarcoma it is a specific." He says further—"The vicious causative effect of tobacco in the mouth is demonstrated. Leucoplakia has no curative remedy unless it be radium." Dr. Abbe is given the credit for being the first in America to introduce tubes containing radium into the center of tumors. The reported results in sarcoma are good and Dr. Wickham of Paris has been equally successful.

Dr. W. H. B. Aikins of Toronto in the *Canadian Practitioner* in a paper entitled *"Recent Observations on the Therapeutic Use of Radium"* reports as follows: "This brings us to what seems to be the great hope from radum treatment. It is the combination of surgery with the use of radium. The surgeon can devise methods by which the apparatus may be brought into contact with the deep-lying malignant growths, particularly those in bladder, rectum and uterus. Cases have been reported in which, by such a combination, either an inoperable case has been converted into an operable one or after the surgeon has removed all of the growth possible, radium has been used with good effect on the malignant tissues remaining. Furthermore, radium has been used after operations for malignant growths infiltrating the operative area with rays, so as to kill any cancer cells which may have been missed at the time of operation." He cites a case of a farmer, aged fifty-three, who in February, 1909, noticed a lump at the angle of the jaw on the right side. X-rays were used without any apparent effect as the mass was increasing. In April, 1910, the tumor was removed and proved to be a round-celled sarcoma. In June, it recurred; excision was again advised but a facial paresis had followed the first operation and the patient would not consider further operative procedures. He was, therefore, referred for radium treatment. The cross-fire method was used, a placque being placed on each side of the tumor. The beginning of October the mass was two inches in diameter and elevated three-quarters of an inch, and was attached to the angle of the jaw. On October 5th, an incision was made into the tumor and a small silver tube containing one centigram of pure bromide of radium with an activity of two million, was inserted deeply into its center and left for twenty-four hours. At the end of this time there was a cavity into which the finger could be inserted; the growth felt much softer and was more movable. Broken necrotic tissue was discharged from this opening. This treatment was repeated in twelve days except that the tube was inserted for only two hours for six days with a placque

applied externally to produce cross-fire action. At the end of one month, no tumor mass could be seen and on palpation two small masses which felt like scar tissue could be felt. We regard this as a most gratifying result, but he would be a foolish man indeed who would in any sense regard the case as cured.

The following changes have been seen to occur in neoplastic growths where radium had been used and subsequently growth excised.

First—A hypertrophy is noticed but if sufficient dosage is given, an elective cellular necrosis supersedes and when necrosis becomes marked, the connective tissue cells multiply and there is a marked leucocytic diapedesis.

Reporting again from *The Canadian Practitioner,* a paper by Dr. Aikins—*"Radium in the Treatment of Sarcoma,"* in which he says, speaking of the changes due to radium: "The parenchyma which has proliferated prematurely and irregularly, is badly fitted to resist the shock of the emanations of radium and the deficiently nourished and inadaptable cells succumb quickly under conditions in which the normal types, from which they are derived, would resist. Further, the more the cytological type of the tumor is removed from the normal adult type, the less resistant is it, and thus amongst the sarcomata the atypical cell is less resistant than the fibro-blastomela." My own faith in radium makes me feel that in direct proportion to the proximity of the radium rays to the individual atypical cell, will the greater success or failure of this form of treatment be noticed.

Surgical Treatment of Trigeminal Neuralgia.

By Harry M. Sherman, A.M., M.D., F.A.C.S., San Francisco.

The subject given to me by the Chairman of this Section, "*Surgical Treatment of Trigeminal Neuralgia,*" excludes from my consideration the incidence and pathology of the condition. In one respect this is not a disappointment for the study and discussion of the pathology has, up to the present time, been a rather barren matter, no definite anatomic nor structural change in nerve trunk nor the Gasserian ganglion having been found and such finding having been confirmed.

Possible Relation of Focal Infection to Neuralgia.

The incidence of the disease and its etiology or pathogeny is different, for at the present time one is tempted to turn to the focal infections to explain, perhaps, many of the hitherto inexplicables, and, in this instance with a fair hope of success; for neuralgia means nothing but a pain having its origin and seat in a nerve and the records are already loaded with reports of cases of pain in some region of the body which has disappeared when a focal infection has been found and removed. I do not include in this reference those sub-infections, from which the original pathogen can be recovered from the tissues showing the direct relation of the sub-infection to the primary infection. These cases present symptoms other than pain. I include only the pain cases which recover from the pain as soon as the focal infection is properly drained and elapse to the painful state as soon as drainage is interfered with. The inference is that these are cases of toxic neuralgia, and that it is almost more than an inference I am sure you will allow.

Trigeminal Neuralgia.

That the chief neuralgia, trigeminal neuralgia, must have been due in the first place, and in the absence of an anatomic explanation, to some toxic cause situated, perhaps, not far away, seems most plausible and it is by this theory that it may be connected with your special function. I am not forgetting, you must be sure, that we have all seen patients with trigeminal neuralgia who have sacrificed all their teeth in the hope of getting relief from the pain and have failed to get it, but this sacrifice

has, in the past, not been directed nor controlled by the present-day knowledge of mouth infections, nor by adequate radiographs of teeth and jaw-bones, so that it has never been a well planned attack upon a pathologic region, but an indiscriminate attack upon a possible, but not proven to be a probable, source of the pain cause. Careful studies of mouth and tooth infections in the earlier stages of the neuralgia, before the habit of pain (if there is such a thing) has been impressed upon the nerve, may result in regulating the condition and saving the patient much suffering.

Surgical Treatment.

Turning to the treatment by surgical measures of the patient who has a well established tic-douloureux, we find ourselves using to-day one of three methods. First, attacks are made by closed injections into the nerve trunks after their exits from the cranium or before that exit; or second, attacks are made by injections, through open incisions, into the nerve trunks after they have reached relatively superficial locations; or third, attack is made upon the nerve and its ganglion within the cranium with the intention of removing the ganglion and some of the nerve trunks.

Treatment by Injection into the Nerve.

The first of these, an attack by a closed injection into the nerve trunks at or immediately after their exit from the cranium, is to-day the method of first selection. This method, introduced by Schlösser, Ostwalt, Lévy and Baudouin primarily reached the nerves by approach through the mouth, but the last named—Lévy and Baudouin improved the technique in that the approach was through the relatively aseptic skin and not through the septic buccal mucosa. The substance injected has been eighty per cent. alcohol with or without the addition of a small dose of cocain for its local anesthetic effect to control the pain due to the alcohol. Clinically this injection stops the pain if it has reached and entered the nerve, and the reason of this result is now given us by W. B. Cadwalader of Philadelphia, who has found, in dogs, that "alcohol destroys the nerve tissue by dissolution, coagulating albuminous material and dissolving lipoids. The nerve fibres were entirely destroyed by the stronger solutions"—as the eighty per cent. solutions—"yet they appeared in a favorable condition for ultimate regeneration and recovery of function." Again he says: "There is abundant clinical evidence to prove that after destroying the nerve by injecting alcohol, regeneration and restoration of function does occur, provided complications do not interfere." This is the only criticism of the method, that the result is only temporary, for from Schlösser, the originator, to Patrick of Chicago, the chief exponent of the method in America, and including the rest of us who practice it, the experience has

been the same. Schlösser's average of relief is stated as being ten and a half months (quoted by Cadwalader).

I do not intend to weary you with descriptions of the techniques of reaching the various nerves. Two points only need be mentioned. First: the patients must be conscious so that their sensation may be a guide as the needle-point reaches the nerve. This does not preclude the proper anesthetization of the skin and subcutaneous tissues before thrusting in the rather blunt needle, but that you will need the help of the patient's sensation in the depths is made evident by the second point. Second: the variable physiognomy of an individual is not limited to his face; the variations extend to and include the base of the skull. The minute directions given for the selection of the place of puncture and the depth of it cannot possibly apply to all faces and skulls, and the surgeon must show his judgment in modifying the detail in his different patients. Personally I have found that, having by successful variants of the technique of the puncture located the nerve which was to be injected and then written down the personal technique of that individual, I could, on a second injection, by following that personal technique, reach the nerve with no difficulty.

It is trite advice to suggest that the surgeon should always "read up" these little operations each time they are to be done, and that he should have a skull in his operating room. The *Operative Surgery* book will tell him much, but the empty skull may tell him more.

Injections into the Ganglion.

Injections of the Gasserian ganglion by alcohol without its exposure by craniotomy is also practiced. Frazer and Wilfred Harris have developed methods and the latter's is simple and direct; moreover, by the injection of the ganglion a more lasting anesthesia, in the entire nerve distribution and relief from the pain is attained, and the risk to the patient, in the hands of a careful surgeon who is also a good anatomist, is not great.

Detailed description of the technique would here be out of place. As regards the result, Binnie quotes Patrick as saying that "a permanent cure could hardly be expected from injections, but the operation is trivial, usually gives at least temporary relief and may apparently be repeated indefinitely." Finally it is to be remembered that the extension of the alcohol injection method to mixed or motor nerves is dangerous, as the alcohol has no selection for the sensory nerves, but disintegrates the motor fibres as well, with resulting paralysis.

Injection into Peripheral Nerves.

In a recent case in which I had not succeeded in putting the alcohol into the nerve at the first trial, and the patient refused to permit a second trial without a general anesthesia, so that the second trial not surprisingly failed also, I reverted for the third attempt to the injection of osmic acid into the peripheral nerves. This method, suggested by Bennett in England, and first written of in America by Murphy of Chicago, consists in exposing the branches of the fifth nerve above the orbit, below the orbit, at the mental foramen, in the roof of the mouth, in the posterior palatine canal, and in the floor of the mouth, and then injecting these various branches with a 1.5 per cent. or 2 per cent. solution of osmic acid. The solution injected by a fine needle, is placed in the substance of the nerve, and between it and the bone in the case of a nerve in a bony canal, and it must cause the same degeneration of the nerve fibres as does the alcohol, already recited. At first the various nerves were exposed by incisions through the skin; now only one branch requires that, the supraorbital, all of the others being easily reached through the mouth, and the wounds, left open, have always readily healed.

The simplicity of the manipulation and the superficial portion of the nerve exposed and injected were both matters for comment by one who had formerly only done the intra-cranial operation.

I very well remember the first instance in which I did it and how I felt that I had put the patient through a wholly futile procedure because a major pain could certainly not be stopped by a minor operation. But it was so, and the relief lasted many months; and then a repetition of the injection gave again a period of painlessness.

While it is true that this method was efficient and while the technique was *absolutely* not complex, it was *relatively* complex in that incisions were required, and so the still simpler plan of closed injections—which I have spoken of first though it was the last in point of time—has supplanted it.

Operation upon the Ganglion.

Failing a result of sufficient duration to make it worth while by these methods of superficial injection through an incision with osmic acid solution, or deep closed injection with alcohol and cocain solution, one passes, without consideration of superficial neurectomies, to the matter of an intra-cranial operation upon the ganglion, or the sensory root behind it. In this the opening of the skull is the threshold. Now anatomically this is a low threshold for, apart from the skin and the temporal muscle, only connective tissues are injured, and surgically it is a low threshold for to-day's technique makes a craniotomy an operation of no greater surgical risk than a laparotomy, though it may take longer in the doing. As far back as 1904, Cushing speaks of the low

mortality following the operation, then about five per cent. To-day the mortality is less and I cannot quite see why there should be any purely operative mortality, but this obtuseness or optimism of mine is probably due to a short series and some extra good fortune.

The great point in the intra-cranial operation is the certainty and permanence of the relief from pain. The only cases in which the pain can persist are those in which it was of central origin and therefore not a neuralgia, and these are obviously inappropriate for any but a central operation if one can be done. The contrast between the intra- and extra-cranial operations was demonstrated by a patient of mine who had the pain in each trigeminus. On one side I did an intra-cranial removal of the ganglion with permanent relief. I could not repeat this on the other side because I would have quite paralyzed the elevators of the lower jaw on both sides, and left her unable to close the mouth or masticate, and so I did a superficial osmic acid operation on the remaining side and got a complete, but only a temporary relief, which required for its maintenance other procedures at various times during her life.

It must not be thought because I speak briefly of the intra-cranial operation on the ganglion and quote but a low operative mortality, that the operation is trivial. On the contrary, it is to be rated as a major operation done for a major condition, just as an appendicectomy, done in an interval between attacks and followed promptly by a normal healing, so that the disability is insignificant, is still a major work in that it opens a body cavity. And the ganglion operation, opening the skull, is a major operation though promptly followed by normal healing, and not keeping the patient in bed more than two or three days.

Osmic acid followed and replaced in part the ganglion operation cases, but the older ganglion operation was still used for some cases, as those which did not yield to the injection, or yielding still relapsed so soon that the frequency with which injections would probably be needed was so great that the intra-cranial method was selected as a better one. It has remained the best method until recently, when the injection of the ganglion itself with alcohol by the closed method has given such long periods itself that it seems reasonable to expect that result to be permanent, and if it is so, the injection of the ganglion becomes a doughty opponent to the removal of the ganglion. The closed injection is already in the first place for the first trial and, as one's skill in placing the alcohol increases with practise, it is not improbable that injecting the ganglion may be a routine instead of an exceptional act, and the intra-cranial method may be practically abandoned. That would seem to me to be a wholly logical expectation, the evolution of surgical technique always passing from the complex to the simple, and from the less to the more efficient methods showing its human character and holding out always the hope of still greater simplicity and efficiency.

"The X-Rays in Oral Surgery."

By Howard R. Raper, D.D.S., Indianapolis.

Of all dentists, the oral surgeons were the first to make extensive use of radiographs. Following closely on your heels were the orthodontists and the exodontists. The last men to use the X-rays are the men whom radiographs can help most—the general practitioners of dentistry.

Oral surgeons as a class were not only the first dentists to make extensive practical use of the X-rays, but, as one might expect, they were the first to see the limitations of radiographs. The general practitioner of dentistry who is just now taking up the consideration of the radiograph talks much—too much—about "absolute accuracy." He says, in the language of Philo Gubb, "Let us make doubly certain absolutely sure by making a radiograph," just as you said similar things until you learned from experience not to depend too implicitly on radiographs.

I take it that oral surgeons have passed through the four stages of knowledge radiographic, through which all who use and continue to use radiographs must pass: First there was the stage when you did not use radiographs, not knowing how they could help you. Second, came the stage of enthusiasm when you expected the radiograph to show you everything you wished to know. Third, the stage of disappointment, at which stage men declare radiographs worse than worthless. And fourth, the stage of common sense, when you accept the radiograph faults, limitations, *et al.*, as an absolute necessity in practice. I take it, I say, that oral surgeons have arrived at the fourth stage, and I congratulate you on your progress, and I solicit your assistance in helping the general practitioner of dentistry on to this final stage.

The following uses of the radiograph in the practice of oral surgery are taken from the list of "The Uses of the Radiograph in Dentistry" as they appear in my book, "Elementary and Dental Radiography." The list itself then will be familiar to many of you, but the consideration of each use following their enumeration will, I believe, be found less hackneyed.

Uses of Radiographs in Oral Surgery.

The uses of the radiograph in the practice of oral surgery are: (1) In cases of unerupted, malposed or impacted teeth. (2) In cases of dento-alveolar abscesses. (3) In cases of persistent suppuration which do not yield to the usual treatment. (4) To observe the course of a fistulous tract. (5) To observe the field of operation before and after apicoectomy. (6) To locate foreign bodies, such as bullets, broken needles, etc. (7) To determine the presence or absence of a bit of tooth root imbedded in the gum tissue. (8) To diagnose fracture of a tooth root. (9) To locate stones (calculi) in the salivary ducts or glands. (10) In cases of cysts. (11) In cases of tumor. (12) To observe the location and extent of a necrotic or carious condition of bone. (13) To diagnose antral empyemia. (14) To observe the size, shape and location of the antrum as an aid in opening into it. (15) To locate foreign bodies in the antrum. (16) To observe cases of luxation. (17) In cases of fracture before and after reduction. (18) In cases of ankylosis of the temporo-mandibular articulation. (19) To observe the field of operation before and after resection of the mandible. (20) In cases of facial neuralgia with an obscure etiology. (21) In cases of facial fistula.

We will now take up each of the radiographs in the practice of oral surgery as enumerated and comment on it, the comment being the product of the last four years' experience.

1. In cases of unerupted, malposed and impacted teeth the use of the radiograph is recognized to be an absolute necessity. Because it is a flat picture—*i. e.,* almost entirely lacking in perspective—the radiographer does not disclose the *exact* location of malposed teeth. In answer to such statement as this, some illogical fellows say to me, "If the radiograph does not show the *exact* location or unerupted, malposed or impacted teeth, then why use it at all? It does not show you what you want to see." The answer in metaphor is, while the kerosene lamp falls far short of being the ideal light, we would nevertheless use it, and consider it a necessity if we had no other kind of light.

Stereoscopic Radiographs.

We may as well consider here, since we have mentioned it, the greatest shortcoming of the radiograph, namely, its lack of perspective. Stereoscopic (see solid) radiography, which involves the making of two radiographs of a part, one radiograph of each eye, to be viewed with a special device, a stereoscope, gives little promise of overcoming this fault. To the present time dental stereoscopic radiography has proved a failure, so far as its practical application is concerned, at least. A few dental radiographers have struggled with this problem, and some

claim to be able to produce satisfactory dental stereo-radiographs. Let me say, however, in perfect good nature and modesty, that I have seen no dental stereo-radiographs which are any better than the ones I have made myself, and the ones I have made are "no good"; they have no reliable advantage over the single, well-made radiograph.

As I see the matter, two great barriers stand in the way of successful dental stereoscopic radiography: First, the exacting and elaborate technique involved, and second, the size of the teeth.

Any kind of stereoscopic radiographic work necessitates the use of special apparatus and is difficult, but the difficulties encountered when making stereo-radiographs of teeth are more numerous and harder to overcome than those met when stereo-radiographing any other part of the body.

The second barrier—the size of the teeth—is more fundamental in its nature. The ease with which we see perspectively varies according to size. The smaller the objects the more difficult it is to see them perspectively. If we could make stereo-radiographs of the teeth with as much ease and accuracy as we make them of the thorax or extremities —and we cannot—even then our results would not be what we want them, for the teeth are so much smaller than the thorax or extremities.

While the barriers in the way of successful dental stereoscopic radiography are high, I would not have you understand me to say they are insurmountable. I do not think they are. But, granting the possibility of producing satisfactory dental stereo-radiographs, it seems improbable that they will be of much practical value, for even in this imaginary success of the dental stereo-radiographs, I can imagine them being made only by the most skilful specialists and at a cost which would be prohibitive to most patients.

Let us get back to the context, having digressed to learn that the problem of producing dental stereo-radiographs with reliable perspective is too difficult for us to solve just now. However, the apparently impossible is constantly being accomplished—the radiograph itself is an example of this.

2. In cases of dento-alveolar abscess the radiograph is used to determine which tooth is responsible for the abscess, the extent of destruction of tissue and the number of teeth involved. Its value for these purposes is well known, but its limitations are not fully appreciated. Radiographs do not show the exact extent of destruction of tissue, because they lack perspective and, for the same reason, the inexperienced radiographer may read a radiograph to show the involvement of teeth in an abscess sinus which do not penetrate the sinus at all, but are situated buccally or lingually of it.

3. In case of persistent suppurations which do not yield to the usual treatment the radiograph often discloses the cause, and even though it fails in this, it always eliminates certain possible causes, such as odontoma or impacted teeth, for examples, and so leads to or toward a diagnosis by elimination.

4. One of the most accurate and satisfactory means of tracing a fistulous tract is to inject it with bismuth paste, then radiograph the part.

5. I can perhaps impress you with the value of making radiographs before operating to excise root-ends by relating this experience: Dr. Carl Lucas, who was to give a clinic on apical excision before the Indianapolis Dental Society, asked that a patient be selected for him from the Indiana Dental College clinic. The demonstrators in the college clinic were advised of this and asked to select a suitable case and send it to me for a radiographic examination. Thus the cases which came to me were those in which the symptoms were such as to indicate apical excision. Apical excision was seen to be contra-indicated, however, in the first case, when the radiograph showed the root of the tooth to be abnormally short; in the second case, when the radiograph disclosed the presence of a perforation; and in the third case in which the destruction of bone was too extensive. In the fourth case, the radiographic finding indicated apical excision, thus finally substantiating the conclusions based on a knowledge of symptoms. In the light of this unusual but instructive experience I would insist that the operator should always make a radiographic examination before operating to excise a root-end.

6. Everybody who knows that there is such a thing as a radiograph knows also that it is used to locate foreign bodies. Its value for this purpose has never been questioned.

7. The use of the radiograph to locate pieces of tooth roots imbedded in the gum tissue or jaw is daily proving to be one of the most gratifying uses to which the radiograph can be put.

8. In all cases of traumatism it is rapidly becoming routine practise to radiograph the parts to learn if there is a fracture of the roots of the teeth involved in the traumatism. When used for this purpose the radiograph practically never fails to impart the information desired.

9. Since there are comparatively few cases of calculi in the salivary ducts or glands, the use of the radiograph to locate them is accordingly limited, but it has been found efficacious when employed.

10. In cases of cyst, and especially of dentigerous cyst of the jaws, the radiograph is doing all we have expected it to do. It has developed no discouraging shortcoming.

11. In cases of tumor, the radiograph alone may disclose the exact size, shape and nature of a tumor, as in cases of odontomata and cementomata for example, or it may fail entirely to lead you to a diagnosis except by elimination and microscopic examination, as in a case of mylosarcoma, for example. Thus in tumor cases the radiograph may enable you to make a diagnosis or it may simply eliminate certain possibilities. Because it does the former sometimes, there is always a feeling of disappointment when it does only the latter, this feeling of disappointment becoming so acute that the diagnostician forgets about the possible things which have been eliminated. He remembers only that he has not yet made a diagnosis and says the radiograph has been of no value at all, which is not the fact.

12. One who has had little or no experience in dental radiography expects the radiograph to show clearly the line of demarcation and the sequestrum in cases of necrosis. I have seen, in my entire experience in the work, only two such radiographs. The radiograph is of great value in most cases of necrosis and bone caries, but let me admit frankly that it has not been as useful or reliable as I thought it would be when I first started to do radiodontic work.

13. Aside from a consideration of symptoms, the two accepted means of diagnosis of antral empyema is by the use of the radiograph and by transillumination. Transillumination is more convenient, less difficult and less expensive, and, therefore, more popular. The advantages of the radiograph over transillumination are: first, a permanent record of the examination is made on the negative, which may be studied leisurely and referred to in later years if desired; second, a reliable examination of the other auxiliary nasal sinuses is made simultaneously with that of the antrum.

14. The use of the radiograph to determine the size, shape and location of the antrum has seldom been resorted to, and then with only indifferent results.

15. The use of the radiograph to locate foreign bodies in the antrum is attended with much success if the operator is satisfied simply to see that there is a foreign body in the antrum. But if he expects to learn the exact location of the body he will usually be disappointed.

16. It is seldom necessary to radiograph a case of mandibular luxation, but it may be done with success if the operator deems it advisable.

17. It has become routine practice in general surgery to radiograph all cases of fracture. The parts treated by the oral surgeon are more difficult to radiograph than most other parts of the body, and radiographs of the jaw are therefore comparatively less satisfactory. However, they are of sufficient value to be indispensable.

18. In cases of ankylosis, if false, the use of the radiograph will nearly always disclose its cause, the cause being usually an impacted lower third molar. The use of the radiograph then in cases of ankylosis is proving satisfactory.

19. Resection of the mandible is a serious operation. The operator accepts the help he can get from a study of radiographs of the parts consistently and gratefully.

20. In cases of facial neuralgia with an obscure etiology the radiograph may always be used to advantage, which is not saying at all that it will always disclose the cause of neuralgia. Even when it fails to disclose the cause of the neuralgia, however, it will eliminate such possible causes as impacted teeth, supernumerary teeth, imperfect canal fillings, odontomata, cementomata, pulp stones, and others. When the radiographs fail to enable you to make a definite diagnosis, you will, of course, be disappointed, but a radiograph cannot be used at all in a case of neuralgia without being of some value, since it is bound to show, if not the cause of the trouble, then that some certain things *are not* the cause of trouble.

21. Cases of facial fistula when radiographed almost invariably show some dento-osseous lesion. The use of the radiograph then in these cases is proving very satisfactory.

In conclusion: New methods and things introduced into medicine and dentistry are often received with over- and irrational enthusiasm, followed with their equally irrational abandonment. The extensive use of the radiograph in dentistry is new. It is just about to pass through the stage of reaction and over-enthusiasm. Its use will never be abandoned, but let those of us who know its limitations teach those who do not know, lest in their discouragement and misunderstanding they fail for a while to avail themselves of this necessity to service.

Osteoplastic Lengthening of the Lower Jaw in Micrognathy According to von Eiselsberg's Method.

By Professor Hjalmar von Bonsdorff, Helsingfors, Finland.

The Honorable President of the Finnish Dentists' Society has requested me to give, on this occasion, an account of a case of micrognathy, which I have had an opportunity of studying and treating, together with the dentist, Mr. Pehr Gadd. In compliance with this request, I beg leave before describing the method of operation and the results gained, to give first, a short description of the case.

Case History.

The patient, a seminarist, twenty years of age, gave the following statements of his earlier condition. At the age of seven years, he felt pain in the back part of the left lower jaw, without any known reason, besides which a swelling appeared in the cheek. A poultice treatment, continued for a couple of months, resulted in fistulas coming forth, partly in the lower jaw angle, partly in the mouth. All this time, the mastication is said to have been normal. A physician had repeatedly extracted, from the fistulas, small fragments of bone, and lastly, a larger piece of bone. The patient presumed to state that the lower jaw had suddenly turned awry after the extraction of the large piece of bone. However, the fistulas closed and the patient remained completely healed. But at the same time, he noticed that the point of his chin began being displaced more and more to the left, his rows of teeth meeting less and less. Any difficulty of chewing or swallowing he had, however, not had, though, indeed, firm and tough food had caused certain difficulties. Disturbance of speech has not occurred, and it is only from cosmetic reasons that he is now seeking treatment.

Examination Record.

On examination, we are immediately struck with the asymmetry of the lower part of the face. (Fig. 2.) The chin deviates to the left about a digit from middle line. The left lower jaw is shortened and deformed. Immediately before the *angulis mandibulæ*, there is a bend of the lower jaw edge and on palpation through the mouth, it is observed

that the horizontal part of the lower jaw is considerably narrower than in its normal state, and a little curved like an *S*. Besides, the chin has not the usual projecting form, its point is drawn backwards, whereby the profile, the nose being big and protruding, presents the type of a so-called "bird's face." The mouth can be opened to its full width; in the left lower jaw, the corner tooth and all the molars are missing; in the upper jaw, all the front teeth. When the jaws are shut, the teeth of the right

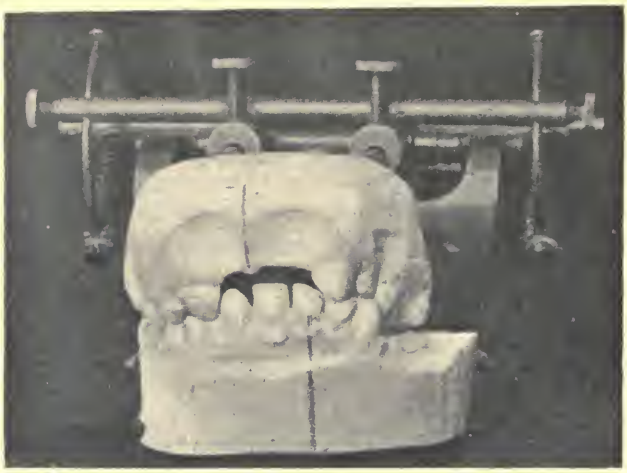


Fig. 1.—Before operation

lower jaw fall behind and inside the row of teeth of the right upper jaw, so that the space between the right lower corner tooth and the last front tooth falls in the middle line. (See Fig. 1.)

Here was, consequently, a case of acquired one-sided micrognathy without ankylosis in the joint of the lower jaw. The cause of the deformity was no doubt to be found in the process of suppuration the patient had gone through at the age of seven years, and which resulted in some parts of the jaw becoming necrotic. The statement that the jaw had begun turning awry after the great sequestration had been loosened, is no doubt correct, as, on this occasion, a pathologic fracture most likely took place.

Methods of Treatment.

In order to find a remedy for this damage and gain symmetry in either half of the lower jaw, it was therefore necessary to lengthen the left half of the lower jaw. For this purpose, there were two ways of proceeding—either to effect the lengthening osteoplastically, or to

break the continuity of the jaw and insert, between the cut-off ends, a prosthesis of suitable length. For obvious reasons, I chose the osteoplastic method, according to a method used by von Eiselsberg for this purpose, and which consists in a *step-notch sawing of the jaw, after which the fragments are drawn out and fixed in the lengthened position by means of sutures of silver wire.*

Before proceeding with the operation, it was, however, necessary to

Fig. 2.– After operation

determine, beforehand, how much the jaw should be lengthened, to become normal, so as to bring the point of the chin to the median line and to make the teeth of the upper and the lower jaw meet and thus useful when chewing. For this purpose, Mr. Gadd had the kindness to take a cast of the jaws, which, inserted into an articulator, gave a clear picture of the normal position of the jaws and teeth. Now, it was shown that if the left lower jaw was to be lengthened so much that the corner tooth of the right lower jaw came to lie immediately outside the corresponding tooth in the upper jaw, the desired results would be obtained. Then we decided to try, after breaking the continuity of the jaw, to fix the above-named teeth to each other, in order to keep, in this way, the lower jaw in a right position, and thus secure the healing.

The operation was executed in the following way:

Operation. By a cut along the edge of the lower jaw, the latter was bared, the periosteum was cleft and loosened from the bone. The horizontal part of the lower jaw had been changed into a round bony part about the thickness

Fig. 3 (Before)

Fig. 4 (After)

Fig. 3 (Before)

Fig. 4 (After)

of a finger, which was slightly bent like an *S*. Immediately before the *angulis mandibulæ*, a cut was made, by means of a thin saw, from the edge of the lower jaw upwards—thus, at right angles with the length of the bone—as far as the middle of the bone. A similar saw-cut was

made further on, from the upper edge of the jawbone downwards. Before the distal cut and behind the mesial cut, two holes were bored, upon which, by means of a thin chisel, conducted along the length of the bone, the ends of the saw-cut, situated in the middle of the bone, were united In this way, there arose a step-notch breaking off of the jawbone. When silver wires, inserted into the bored holes, were tied together, the intended lengthening of the jaw was effected, the different parts of which having been sewn together, had, in consequence of the step-notch, rather a large surface of contact with each other. (Fig. 2.) The periosteum and the skin having been sewn up carefully, both the corner teeth on the right side were fixed to each other, and a bandage was applied, which pressed the jaws well against each other. No care, as to the nutrition of the patient, had to be taken, as there were, in the two rows of teeth, gaps large enough for the food to pass.

The further course of healing after the operation was completely undisturbed, and three weeks later the patient was able to leave the hospital. The result of the operation will best be seen from the enclosed pictures. (Figs. 1, 2, 3 and 4.)

Previous Operations.

In this connection I would like to say a few words about some other osteoplastic methods of operation on the lower jaw—less intended to effect a lengthening of it than to fill defects in consequence of resections. At first, I want to mention some ways of using some parts of the lower jaw situated near the defect. Wildt describes a method by Bardenheuer, who uses a square piece of bone covered with periosteum, extracted in the immediate neighborhood of the defect, which piece of bone remains behind and below, in connection with the muscularity, and which is thus pushed upwards. A similar proceeding was tried by Sykoff, when filling up a defect of the chin with a piece out of the left lower jaw. Krause, too, has used with great success a skin-muscle-periosteum-bone-lambeau. Pieces of bone, situated farther off have also been used for this purpose. Thus, Bardenheuer made an experiment with a skin-periosteum-bone-lambeau from the forehead, while Wölfler and Rydygier have planted into the jaw defects, pieces of the collarbone, in connection with the covering skin. Payr has used with success, pieces of the first rib, partly in such a manner that these pieces have been allowed to remain in connection with the covering skin, as a styletted lambeau; partly by using entirely loosened pieces of the rib. Thus, there are various proposals concerning methods of inserting a living material into the lower jaw, and in this way effecting a lengthening of the bone. Among these ways of proceeding, the method of operation, described by

von Eiselsberg, however, occupies the first place, as the way in which the purpose is gained, must be considered to be very simple and to give the greatest possible chances of satisfactory healing.

In this connection nothing has been said about the use of prostheses. This question, however, I did not want to enter upon, but beg to advance the fact that, as the purpose intended can be attained by using living material, the latter should always be preferred to dead material.

Shot-Fractures of Jaw-bones.*

By Professor Dr. Rudolph Weiser, Vienna, Austria.

Prof. Dr. Weiser commences his "demonstration of shot-fractures of the jaw-bones of several cases under treatment" referring to a series of wall-charts and with a short description of the older as well as the newest methods of prosthetic and orthodontic treatment of shot-fractures of the jaw-bones applied at present. Then the lecturer presented twelve patients who were in different stages of treatment. Nine of them were already healed and furnished with a temporary dental-splint which makes normal chewing possible so that the patients' state of nutrition, though very low during the initial stages of treatment, may be called perfectly satisfactory at present. Most cases were shot-fractures of one of the two horizontal bones of the mandible with a considerable dislocation of the great as well as the small fragment. These dislocations were set right in the most exact manner by the dental-splint. Preparing the apparatus, redressing the position of the fragments, was begun as soon as the patients had arrived at the hospital. Fixing the fragments in their proper position produced an essential change in the patients' state of health. Only in a secondary way did Prof. Weiser treat the injuries of the soft tissues about the jaw. These treatments of the soft parts involve deep and extensive incisions, the extraction of loose sequesters bathed in purulent matter and highly loosened teeth; filling of deep abscess-cavities with Mosetig's bone-filling after a perfect cleansing and curetting of the seat of granulation, etc.

In one case, particularly depressing at the beginning of treatment, the bottom of the mouth-cavity was torn by shrapnel in such a way that one could see the lower side of the tongue from the mandible, and that saliva, matter and nutritive fluids flowed from the wound almost irresistibly. After putting the two mandible fragments in splints by a metal cap cemented on the three teeth still left, Weiser began closing the wound in the mandible, leaving a drainage-tube in one place, thus providing for

* Author's report of the lecture held on November 20th, 1914, in the Imperial Royal Society of Physicians.

the flow of matter coming from superficial, sequestered lamelas of the lingual *corticalis mandibulæ*. After eight weeks' treatment the patient is so far advanced that already the preparation of a definite substitute may be begun. In most cases the lecturer used a modification of the "Schröder bar" with the best success. In simple cases, as e. g., with fractures near the symphysis, and in case of perfectly clear articulation of the fractured mandible with the maxillæ, it appears very simple and practicable to use the metal cap cemented on the teeth left as mentioned by Heath, though, of course, it must undergo certain modifications and combinations with screws and bars where gaps between the teeth, or tilted teeth with diverging axes are present. In one case of very extensive injuries in the maxillæ, which would not heal for a long time, the lecturer availed himself of the extra-intraoral bandage of Bimstein. It consists of a palate plate covering and fixing in a proper position, the roof of the palate which had sunk down to the tongue. This roof plate is supplied with two horizontal metal bars, symmetrically coming out of the mouth and running parallel to the cheek, with elastic bands leading to a cap fitted to the skull.

Summing up his experiences the lecturer decidedly maintains that the orthopædic treatment of fractured jaw-bones must on no condition be delayed till the injuries of the soft tissues may be healed, but that the making of a prosthesis must be begun at once, without of course neglecting either the general treatment or the surgical treatment of soft tissues.

The lecturer showed two cases not yet treated. One case was that of a corporal who since being wounded at Schabatz (Servia) had for three weeks lacked special treatment. The mandible is broken in five pieces, the teeth in such a chaos that the patient is scarcely able to talk or swallow. Nauseous *fetor ex ore,* present at the beginning, and the ample flow of purulent mucus and saliva have been nearly altogether stopped after two or three days by proper wound treatment and application with one per cent. hydrogen peroxide every two hours. For the rest, chewing is of course entirely impossible as yet and the patient can take liquid food only. The splints for the fragments are however being prepared and the lecturer is perfectly convinced that within a few weeks the patient will be able to use his jaws and by then be furnished with splints, for chewing.

Another case is interesting inasmuch as seemingly unhurt. Only the expert recognizes that the rows of teeth do not properly articulate and sees at once that the patient's statement that he could not chew is truthful. The cause of the disturbance of the chewing function, very serious for the patient, is due to a smashing of the right *capitulum mandibulæ* by a

bullet. Also in this case a perfectly satisfactory chewing function will be attained by using the bar. Before that, however, one must, by using an elastic band running from the bar of the maxilla to that of the mandible, overcome the already present contraction caused by the patient's having been able to be treated dentally, only after the healing of a necrosis of the right ear also caused by the bullet; dental treatment was impossible as long as the case was fresh and the *otitis media* florid, because the patient was suffering from continual faintings and epileptic fits, which, however, have ceased now.

The Treatment of Radicular and Follicular Dental-Cysts.

By Professor Dr. Rudolph Weiser, Vienna, Austria.

However pleasing it would be to search the old as well as surprisingly voluminous literature on dental-cysts with regard to the historical development of the therapeutics of this interesting disease, the short space granted for my report compels me to cut down my paper and to limit it to several ways of treatment in the present question.

The method of incising dental cysts has rightly been abandoned; nay, it ought really to be called a fault of art, because it is of no avail, but as is often shown when cysts are mistaken for abscesses the generally aseptic contents of the cysts, may suffer infection with all its consequences.

Even the extraction of the tooth in question is (perhaps with the exception of really small cysts) without success, as the latter will independently develop even after the tooth has been extracted.

Puncture, recommended years ago, with or without a subsequent injection of iodin, does not lead to any result.

When we follow the classical statements of Perthes in his book on *"Verletzungen und Krankheiten des Kiefers"* (Injury and diseases of the jaw) that mine of all valuable knowledge of pathology, pathogenesis and therapeutics of dental-cysts, we will find that the actual treatment of to-day divides according to the principles underlying it into two distinct channels.

While Magitot still advocates incision followed by drainage, the younger French authors, as Albarran, Heydenreich, Jacques, attach the greater value to the extirpation of the entire cyst. To this hyper-radical method the above named authors and their disciples are induced by the danger of recurrences, which are said to appear again in form of unilocular and multilocular cysts, when by the operative treatment of unilocular cysts the extirpation of the cystic wall had not been executed thoroughly. The many hundred-fold experiences with the conservative treatment (which later will be discussed) is proof that Perthes was correct when he said: "The few cases of recurrence which support Albarran might perhaps be explained by the fact that the opening of the cyst had not been made broad enough and had closed again before the cyst had become

sufficiently reduced, or when the recurrence appeared in form of the multilocular root cyst. At any rate, up to now there has been no observation made of a recurrence after operations done according to the method of Partsch"

Objections to Complete Extirpation.

The method of complete extirpation of tooth cysts has several drawbacks.

1. Above all it is a difficult operation to perform in the maxilla as well as in the mandible in cases where the location of the cyst extends far back.

2. In case of displacement of the antrum of Highmore, or in cases where the cyst has reduced the alveolar process of the anterior, as also the posterior teeth to a thin wall, which, though still sufficient to afford enough room for the nutritive vessels and nerves, will easily give rise to unpleasant accidents and harm to the neighboring tissues when the cystic wall is entirely extirpated.

As the healing is based upon granulation the healing process, in contrast to other methods (Dupuytren, Heath, Partsch, v. Mosetig-Moorhof, Witzel, Neumann, Neuschmidt, Schröder, Williger) will be unnecessarily prolonged and made unpleasant to both surgeon and patient.

Modern or Partsch Method.

The method most extensively used is that founded on Perthe's directions, first executed by Dupuytren and also recommended by Heath, and which later on was perfected by Partsch and systematically worked out by his disciples, and "which includes the resection of the outer wall of the cyst, so that the hollow of the cyst is made an accessory sinus of the oral cavity." The method now universally practiced as the Partsch operation is based on the ingenious idea not to destroy the plastic epithelium of the cyst wall, but after the most extensive excision of the outer wall to use the remaining part, the epithelium of which will soon connect itself with the neighboring oral mucous membrane, thus forming the lining of the wound cavity, so that one need not depend upon a long drawn out suppuration and granulation in the healing process. The details of the Partsch method with radicular cysts have been given by his pupil Williger in a clear and concise manner in his hand-book *"Zahnärztliche Chirurgie"* (2) Paul Preiswerk (3) also has gained lasting credit in the realm of dental surgery, by his splendid illustrations in his 39th vol. of *"Lehmann's medizin. Handatlanten."*

Furthermore the essayist of this paper has fully treated and then illustrated the different forms, appearance and extension of radicular cysts classified according to whether they start from the central or lateral incisors, or cuspids, bicuspids and molars, whether they press the lamina

vitrea into the *vestibulum oris* and themselves burrow into the spongeosa, or displace the antrum of Highmore; and whether they are aseptic or infected.

Just as is is to the great credit of Partsch that he methodically worked out Dupuytren's cyst technique and established it as a typical operation, it is to his, and the school of Breslau's everlasting credit to have shown that teeth or roots which have become the starting point of radicular cysts, can be saved in a conservative treatment. In his treatise in the *"Deutschen Chirurgie"* which cannot be praised enough, Perthes says: "the carious or pulpless tooth which is to be considered the starting point of the cyst should be extracted before or after the incision of the cyst. Only in exceptional cases may the tooth which started the formation of a cyst be saved by dental methods, particularly in case of a front tooth, which is too badly carious. The first consideration in such cases will be, the removing of the contents of the pulp chamber and canal, sterilization of the canal, filling it and root amputation."

This statement does not satisfy the present state of dentistry. The operative treatment of radicular, as well as follicular cysts is at present left to competent surgically trained dentists. For the modern dentist of this class, a cyst as a rule does not constitute a case for extraction; on the contrary he considers it an error to extract teeth or roots which may be saved by conservative methods, and needed for the purpose of crown and bridgework, or for denta-orthopedic reasons. Only when they cannot be saved, or when they are worthless does the surgeon proceed to extraction when operating on a cyst.

Etiology of Radicular Cysts.

Just as Partsch with an eye to the future, had recognized the possibility of conservative treatment of such teeth and roots, Julius Witzel (5) with enthusiasm adopted the former's method of operation, partly by the aid of the literature, partly based on his own researches. He then proceeded to prove, that in the development of a radicular cyst the dead tooth, or the dead root, is not always the etiologic cause. We know through researches of the above named authors, as well as Parreidt, Röse, Römer, Dependorf, Haasler and many others, that radicular cysts in the great majority of cases, are due to chronic irritations, which are produced by the putrid contents of dead teeth or roots in the root canals on that part of the *"Débris épithélliaux parandentaires,"* discovered in 1881 by Malasek and which are located in the epithelial disk of Brunn-Hertwig, from the time of the development of the tooth, found in the neighborhood of the apical foramen.

Cysts on Teeth with Living Pulps.

However, there are exceptions to the rule. There are cases where radicular cysts are developed on teeth with living pulps. In the two cases, which I have beyond all doubt proven by means of radiography, as well as by the reaction of electric current, there was in one case—a boy of thirteen years—a cyst, the size of a cherry, starting from the upper left lateral incisor; in the other case—a Bulgarian civil engineer—there was a cyst, which displaced the whole of the hard palate, yet there was not even one dead tooth to be found in either mouth though in both cases there was evidence of traumatism, which irritated the epithelial remnants to such an extent, that a cyst was developed, while the nutritive vessels and nerves of the pulp were still alive.

In consequence of these facts it does not matter how carious a tooth causing a cyst may be (since with the exception of the few cases mentioned, we nearly always find carious teeth in radicular cysts) the real question is whether they are curable or not. On the other hand, roots of bicuspids and molars are just as valuable for us conservative dentists, as those of front teeth, if we can still use them through our methods, for abutments in crown and bridgework, as is nowadays everywhere practiced by well educated and conscientious dentists.

Recent Methods of Operations Upon Cysts.

As to recent methods of cyst operation, we must now mention those of Jacques and Hoffmann. Perthes reports: "In cysts of the maxillæ v. Jacques extirpates the cystic wall from the buccal side and then opens a wide communication between the remaining cavity through the bone and nose, either through the maxillary sinus or toward the inferior meatus of the nose, whereupon the opening is closed by suturing of the muco-periosteum. In a similar manner Hoffmann opens the cyst widely by dissecting the mucous membrane of the cyst; he makes a wide opening, packs it, leading the ends of the gauze out of the nose, while the facial wound of the mucous membrane is sutured and heals by primary intention."

Neither method seems to have found any followers. That of Jacques probably for the same reasons, which were mentioned above, when treating extirpation. That of Hoffmann, I should not recommend. First, the after treatment, as well as the fact that the wound will not heal more quickly than the shrinking of the cyst takes place, renders the method difficult. Second, because the long packing from the nose must needs be more tiresome to the patient, than if performed through the *vestibulum oris.*

Neuschmidt's Method.

Highly remarkable, yet strangely omitted in the otherwise comprehensive chapter on jaw cysts in Perthe's book, on *"Verletzungen und Krankheiten der Kiefer"* is the method of Neuschmidt (Dortmund), which consists of removing the buccal wall of the cyst by means of the Pacquelin. For those cysts which push into the *vestibulm oris,* or edentulous parts of the alveolar process, where the bones have already been resorbed, this is doubtless to be recommended on account of its simplicity and strict asepsis. In cases however, where stronger bone walls and long, strong roots are to be found, which must be removed first, it will be best to operate according to Partsch. Likewise, it seems improbable, that in cases of cysts located far back and deep in the substance of the bone of the maxilla or mandible, the Pacquelin could be handled without burning the surrounding soft parts.

Very tempting at a first glance are the methods of filling radicular cysts with some filling material.

Paraffin Method.

According to Perthes, Witzel and Neumann in a few cases filled the cavity of jaw cysts with paraffin, strangely enough without the cysts having been extirpated, and were able to give favorable reports. It is surprising that the cystic wall should have proved itself capable of resorbing the paraffin.

Bone Filling Method.

v. Mosetig-Moorhof, the founder of the method of bone-filling, as well as Ernst (1) used for the same purpose v. Mosetig's iodoform bone filling The cystic wall is carefully and entirely extirpated, then the thoroughly dried cavity is filled and the mucous membrane sutured over the filling. In one case of a cyst in the mandible, where entrance had been made from outside, the wound of the skin closed, and the filling material was covered in without a reaction, although in one case the cavity of the cyst communicated with the oral cavity, through the tooth socket of an extracted tooth. In a few weeks the convexity of the jaw, due to the filling out of the cystic cavity with the iodoform filling, flattened considerably. However, only a few cases have been operated on according to this method, so that a verdict as to whether it has any essential advantages over the simple method of Partsch, may not yet be pronounced.

Schroder's Bone Filling.

More promising yet, would be the filling of the cavity remaining in the jaw bone after the extirpation of radicular as also follicular cysts, by means of the new bone filling of Schröder, prepared after

minute chemical researches and physiologic experiments (6). Schröder found a material as plastic and easily introducable, as the well-known iodoform filling, which becomes so hard in a short time, that it is able to support a weakened, very defective bone and which furthermore stimulates the bone and the periostium to new growth in the proximity of the defects and likewise organizes very quickly. The filling material consists of a powder and a fluid; both parts may be sterilized by heating to 100° C or more; if well mixed immediately before use, they form an exceptionally plastic material which becomes hard in five or ten minutes and, what is the important point, it is about of the composition of the bone itself.

The powder consists of a three basic calcium-phosphate of the formula $Ca_3 (PO_4)_2$. This calcium phosphate occurs in nature as "Phosphorite" and in combination with calcium fluorid as "Apatite." In the bones it represents about 80% of the organic matter.

Schröder writes furthermore: "After sufficiently testing its reactionless resorbing power and capability of organization by animal experiments, we have used it in a series of cases for filling emptied cyst cavities of the jaws, and found, that it heals in, without a reaction and organizes, if the suturing of the mucous membrane is carefully performed. Naturally the lining of the cyst must be thoroughly removed, so that the filling material may be brought into intimate touch with the *spongiosa* of the bone.

Williger refers to the use of Schröder's material for filling of emptied cysts, in the new edition of his "*Leitfaden der Zahnärztlichen Chirurgie.*"

It can hardly be expected that this method will prove satisfactory in all suitable cases. Particularly with smaller cysts in the region of the six front teeth, the bicuspids and the first molars, in easily reachable cysts which offer no difficulties to thorough extirpation of the cyst lining and to exact suture, it will form a laudable novelty on account of saving after treatment. Whether cysts, which are far back, or starting from the last molars, where a complete removal of the cyst lining and a correct suture is hardly possible, will not prove obstacles, and whether in case of cosmetically disfiguring large cysts the *restitutio in integrum* will not last longer than with the Partsch method, the very near future will teach us.

For a lasting success in the root canal filling of roots (which have been recognized as the causes of radicular cysts) an irreproachable technique is of the utmost importance. If not already proved by a survey of the clinical facts it will now be nearly always possible to determine by the aid of radiographic examination, the tooth causing the development or infection of a cyst.

Should Canals be Filled Before or After Amputation?

More than a year ago, a dispute arose between a very competent Austrian dentist and several young German authors of great merit, as to whether the root canals of dead teeth which have caused abscesses or cysts, should be filled before or after the root amputation. Since it has occured to me to fill the root canals after the operation (that means at the moment when the cavity is cleaned out and dried by means of sponges, when the cross section of the amputated or perhaps only freshened end of the root is before me), I am so convinced of the correctness of this method, that I shall never deviate from it.

Exceptions are in those cases, where the canal of a root which serves as the support for a crown or as the abutment of a bridge and contains a pivot, has become the starting point of a periapical disease; Frey (7) and Williger (8) have published their practical experiences therein, to the effect that in such cases it is not necessary to remove the pivots before performing the amputation of the apical end of the root. After three cases closely following one another I can subscribe to this statement.

There is no difference in principle between surgical measures, which have answered in the treatment of radicular jaw cysts and those applied in follicular cysts.

On the whole, even with the latter pathologic growths the method of Partsch will remain the choice, except, as I described in a recently treated case of a follicular cyst of a lower wisdom tooth (9) and as it may prove in a greater degree with cysts about impacted cuspids, according to the particulars of the case in question, more or less important modifications in the details of this method of operation will prove advantageous.

Particularly in very large cysts like those described by Dupuytren, which had reached the size of an infant's head, or in such as Preindelsberger and Jungnickel observed, in which the horizontal and vertical process of the mandible had been involved in the cyst, it will be advantageous to attack the tumor extraorally and to fold the skin including periostium into the cystic cavity in order to serve as a protection of the wound surface.

(Cp. Bramanns, Haasler, in Perthes, p. 79.)

Literaturverzeichnis.

(1) Deutsche Chirurgie, herausgegeben von P. v. Burns. Lieferung 33 a: "Verletzungen und Krankheiten der Kiefer" von Perthes, Stuttgart, Verlag von Enke, 1914.

(2) Williger, Zahnärztliche Chirurgie. Leitfaden der praktischen Medizin, Band I, herausgegeben von Prof. Bockenheimer. Leipzig, Verlag von Dr. Klinkhardt.

(3) Paul Preiswerk, Lehrbuch und Atlas der zahnärztlich-stomatologischen Chirurgie. Lehmanns medizin. Handatlanten. Band XXXIX. München 1914, Verlag von J. F. Lehmann.

(4) Weiser, Festschrift des Vereines österr. Zahnärzte, herausgegeben vom Verein zur Feier seines 50-jährigen Bestandes. Wien, November, 1911. Verlag des Vereines österr. Zahnärzte.

(5) Julius Witzel.

(6) Eine neue Knochenplombe. Vorlaufige kurze Mitteilung von Prof. Dr. Schröder, Berlin. Korrespondenzblatt für Zahnärzte, Januar, 1914.

(7) Frey, Festschrift des Vereines österr. Zahnärzte. Wien, November, 1914. Verlag des Vereins österr. Zahnärzte.

(8) Williger, Mundschleimhaut- und Kiefererkrankungen als Folgen von Kronen- und Brückenarbeiten. Korr.-Bl. f. Zahnhlk. Berlin, 1914. Januar.

(9) Weiser, Ein lehrreicher Fall von follikulärer Unterkieferzyste und deren Behandlung. Oesterr.-ungar. Vierteljahresschr. f. Zahnhlk., 1913. H. IV.

Cleft Palate.

By Dr. Chas. Oakman, Detroit, Mich.

In the surgical treatment of cleft palate and harelip it is of the utmost importance that these cases should be seen by the surgeon as early as possible. In the not far distant past there was quite a difference of opinion among surgeons as to the best time for operating. In looking over the literature we find that some surgeons believed that a child should not be operated on until it was old enough to follow the surgeon's instructions. They believed that it was out of the question to operate, under chloroform and ether, on children afflicted with cleft palate. What a change has taken place in the last thirty years in regard to the proper age for operating and the use of chloroform and ether! To-day the concensus of opinion is largely in favor of early operation, ranging from a few days after birth to eighteen months.

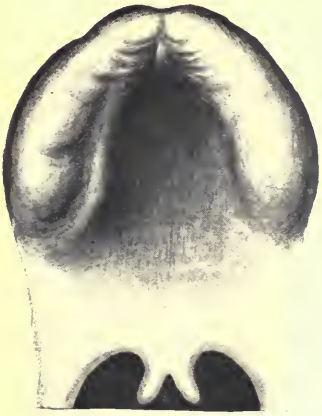
The vast amount written on this subject in the last decade shows that much work and thought have been exercised to the advantage of patient and operator. Consider for instance the elimination, to a great extent of lateral incisions; this alone is a good example of the improvement in surgical technique.

Cleft Palate Described.

A cleft palate is a congenital deformity, characterized by a cleft involving a part or all of the hard and soft palate. In the more severe forms of cleft palate the cleft extends from the tip of the *azygos uvulæ* to the anterior palatine canal. This fissure then bifurcates to communicate with a double alveolar cleft, permitting the forward displacement of the *intermaxilla* or *os incisivum.*

The vomer may dip well down, and in some cases possess quite a width. The inferior turbinate may be found on a level with the vomer, in some cases even dipping farther down than the vomer. The vomer is often attached to one of the margins of the cleft and in conjunction with this condition there is an unilateral alveolar cleft. The attachment always occurs on the opposite side to the cleft.

I will not attempt in this paper to elaborate on the various forms of cleft palate but instead will present on the screen Brophy's fifteen types



FORM 1

Cleft of the uvula (Partial)

FORM 2

Cleft of the uvula extending forward into the fibers of the levator palati and the reflected portions of the tensor palati muscles.

FORM 3

Cleft extending through the uvula and forward to the posterior border of the horizontal plates of the palate bones.

FORM 4

Cleft extending through entire soft palate, including partial or complete cleft of the horizontal plates of the palate bones.

The six types of Cleft Palate represented should be thoroughly impressed on the minds of every physician and dentist. These types should not be operated on before the child is from twelve to eighteen months old. At that time the child is just about to talk and the best results are obtained by waiting until that age.

FORM 5

Cleft of the entire soft palate, through the horizontal plates of the palate bones and into the palate processes of the maxillary bones.

FORM 6

Cleft of entire soft palate and the hard palate nearly as far forward as the original line of union between the palatal plates of the maxillary bones and the premaxillary bones.

FORM 7

Complete single cleft of the entire soft and hard palate. The maxillary bone is separated from the premaxillary bone.

FORM 8

Tripartite cleft, extending through soft and hard palate, separating premaxillary bones from the maxillary bones. Often complicated with double harelip.

FORM 9

Cleft of entire soft palate, extending irregularly through the hard palate. The premaxillary bones are entirely separated from the maxillary bones. Usually complicated with double harelip.

FORM 10

Cleft only between the left maxillary bone and premaxillary bone. May be accompanied by double harelip.

FORM 11

Cleft completely separating both premaxillary bones from the maxillary bones.

FORM 12

Cleft only of the anterior one-half or one-third of hard palate, with protruding premaxillary bones, which are entirely separated from the maxillary bones.

FORM 13

Cleft of entire soft and hard palate, extending through left alveolar ridge. Premaxillary bone partially separated from the maxillary bone on the right.

FORM 14

Cleft of the soft palate, partial or complete, normal hard palate with cleft in the alveolar border.

FORM 15

Cleft only of the alveolar process anterior to the maxillary bones, due to the non-development or absence of the premaxillary bones.

Forms 7 to 14 inclusive should be operated on in early infancy—prior to the sixth month. The bones should be approximated before the hare-lip is operated on. Form 15 is inoperable. There is no tissue with which to make the arch normal.

of cleft palate. To my mind this is the best classification ever presented to surgery on this important subject. It will, I believe, drive home to the student and practitioner the possibilities of cleft palate operations, and the benefits to be derived by the student from this classification cannot to be over-estimated. At once it should be indelibly impressed on the mind of anyone seeing these pictures that the first six forms should not be operated on before twelve or fifteen months; also it teaches what forms of cases are inoperable. After a study of these types the practitioner is better enabled to confer with the parents and the physician as to the advisability and time of operation and the results to be expected therefrom. (Lantern pictures shown.)

Etiology.

Any influence that can effect intra-uterine growth, and this includes arrest of development from any cause, be it hereditary, metabolic or accidental, can directly bring about or predispose to the malformation of the embryo.

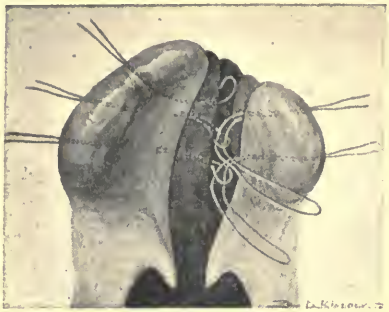
A review of the literature of the etiology of cleft palate will not satisfy one to any great extent, but it is the writer's belief that heredity is an important factor in this condition. It is fair to presume that defective nutrition or general debility of the mother during the first months of gestation may delay the union of the palatine plates. Nature does not fail to develop the necessary bone and soft tissue to form a normal palate, except in rare instances, but it does fail to bring the parts into apposition and union.

Brophy says, "Congenital cleft palate has a predisposing and an exciting cause. The predisposing cause is heredity and the exciting cause is mechanical, the application of force in embryo. Prenatal influences may be a factor in causing failure of union, but proof of this has never been established.

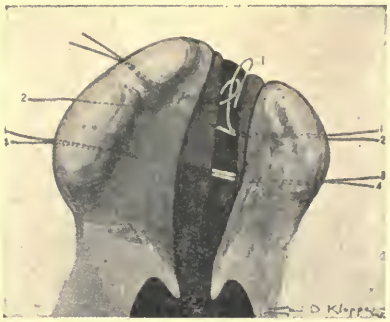
"The bones having failed to unite prior to the fifth month of intra-uterine life, the mandible, as soon as the muscles of mastication become active, brings pressure on the palato-alveolar inclined planes of the superior maxillary bones and acting as a wedge forces them apart and widens the breach. Moreover the pressure of the tongue and the flexed position of the head with the symphysis of the mandible resting on the sternum may contribute to some extent to the force which is exerted by the lower jaw on the palatal arch and this forces the bones apart."

Surgical Treatment of Cleft Palate.

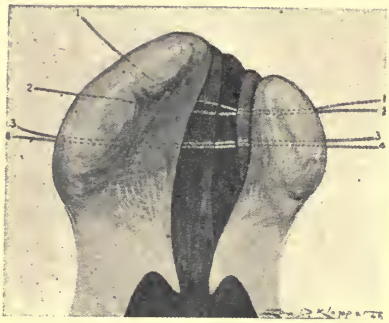
1. The point to consider is the nature and extent of the operation in question.



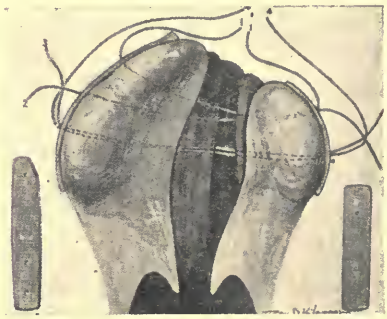
Pilot sutures all inserted



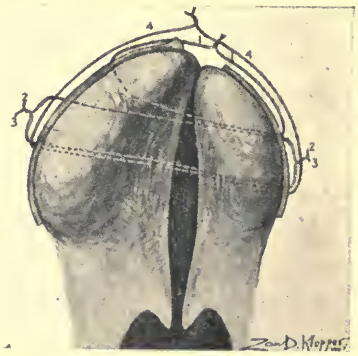
One of the anterior double wires (1) withdrawn from the long side of the bone and passed through the loop of the anterior pilot suture.



Silver wires in place



Wires and plates in position. The method of fastening the wires is shown by numbering each end. Right and left lead plates are shown.



Twisting of the wires completed

After Brophy.

2. As to whether the patient has sufficient vitality and resistance to undergo the shock of an operation.

It is the writer's practice to observe the patients (especially infants) very carefully for some time before operating as to nervous symptoms, weight, temperature and general nutrition. I believe that many patients have been lost through neglect of the foregoing precautions. A child who is steadily losing weight should not be forced to undergo an operation necessitating compression of the maxillary bones.

Technique of Operation.

The method of operating on an infant of three months with cleft of the hard and soft palate extending through the anterior alveolar process is as follows:

The patient having been anesthetized with chloroform or ether a small roll of cotton sheeting is placed on the operating table under the shoulders. This is usually sufficient to extend the head without interfering with respiration. The lip is raised and the new Brophy straight needle-drill, threaded with silk, is carried high up through the maxillary bone behind the malar process, sufficiently high to get into the more solid bone so that the end of the drill will show above the malar process when it appears at the border of the cleft. This needle is designed especially to avoid injury to the teeth. It should not be used in a hurry nor with much force, the surgeon gently feeling his way. The silk is now caught with the tenaculum and the needle withdrawn. This procedure is repeated from the opposite side in the same way, leaving the silk with the closed loops facing each other. The needle-drill is then carried through in front of the malar process from both sides and on the longer side, an extra loop, though farther forward.

By looping one loop through the other and withdrawing the outer loop we now have one double suture extending from one buccal surface to the other. These are replaced by drawing through, by means of the silk, two double silver wires. On these wires are placed perforated lead plates, the holes in which should be just large enough to accommodate the silver wire and are made by using a dental plate-punch. These holes should be placed at a proper distance so that the wires will not cut through the tissue, for if too far apart, buckling of the parts may result. The lead plates should be made smooth before the operation, to avoid irritation of the tissue.

The double closed wires are now cut off at the tips making four single wires. The two middle wires on either side are now twisted together and the posterior and anterior wires are then twisted likewise, care being taken that the same wires are twisted on each side. The parts

Baby B ———— Age 3 Months.
Complete Cleft of hard and soft palate.
Notice the flattened ala of the left nostril and protrusion of the maxilla.
Also cleft of left lip.

Same case four years of age.

are now brought into apposition. This operation should be done as early as is consistent with the patient's vitality.

Where there is an anterior alveolar cleft the operation should be done as soon as possible as the bones are only partly calcified at this time and are more easily brought into apposition. It is in cases of this kind that the family physician or obstetrician can give helpful advice to the parents as to the possibilities of early operation, and in fact a prognosis can generally be made that will relieve many days and hours of mental anguish to the parents. In all cases the physician should advise an early consultation with a specialist as procrastination may result disastrously to the child. These little unfortunates are not good to look upon and it is not only better for the parents and friends but for the community at large that an early operation should be done.

Much inconvenience is likely to occur if the silver wires are not sufficiently long, especially in cases of wide cleft of the anterior alveolar process, for considerable stress is generally necessary to bring the border of the cleft into apposition. This cannot be done properly if the wires are too short to secure a firm hold. Wires should be at least eighteen inches long.

In older infants, where the cleft is wide it may be found necessary to sever the malar process from the maxilla as recommended by Brophy. If the premaxilla is protruding it is best to remove a wedge-shaped piece from the septum, with the base down. The space from which this is removed is obliterated by forcing back the premaxilla, leaving the septum smooth on both sides. The edges of the premaxilla, and the maxilla should be pared in the same way as in the case of the single cleft.

It is not wise for the sake of shortening the time of operation to resort to lateral incisions. The patient should be given every consideration and if double time is required to perform a more thorough operation, time should not be a factor, even at the expense of the operator's back and convenience. Short cuts to success should not be considered in cleft palate surgery.

In swabbing the throat, injury to the coaptation sutures is not so likely if the tongue is drawn well forward. This affords a greater amount of space to work in and also improves respiration. I prefer small pieces of gauze soaked in hot water; these pieces should be thoroughly squeezed out and each piece loosened up to improve its absorbing qualities. If these sponges are not thoroughly squeezed out the water may cause distress to the patient by falling back into the throat. They will be found superior to the dry sponge.

Owen says, "Whether the line of sutures holds or whether it breaks

down these lateral incisions gradually fill up, but inasmuch as they fill up with granulation tissue which is eventually converted into scar tissue, the muscular or aponeurotic fibres of the velum cannot escape permanent damage, which must surely have a prejudicial effect on those delicate movements of the soft palate which make for clear articulation."

Post Operative Treatment.

Under this head the writer cannot refrain from calling attention to the ill effects caused by meddlesome interference with the wound. Too frequent use of sprays, antiseptics, and rough swabbing of the parts may cause serious damage. The wound of course must be kept clean after each feeding and particles of food, milk curds and accumulations of mucus must be removed by careful swabbing by an experienced nurse or assistant. Some children tolerate post operative treatment better than others and each case must be considered individually.

If much blood is lost during the operation, saline enemas or hypodermoclysis should be employed. When the effects of the anesthetic have passed off, rectal enemas or catharsis should be employed to cleanse the alimentary tract.

It has been my practice to feed infants, usually a couple of hours after operating, giving a third to a half the usual amount taken at a meal, using a dropper, syringe or teaspoon to feed with.

Anaesthetic.

It must be borne in mind that an efficient anaesthetist is of the utmost importance. To get the best results the surgeon and the anaesthetist should be accustomed to working together. This also applies to assistants. I know of nothing more distressing than the frequent change of hospital internes. One should have regular assistants on whom he can depend, who know the operator's technique and are ever ready to take advantage of every opportunity to lend a helping hand. In this way only can efficiency and team work be acquired.

Only sufficient anaesthetic should be given to keep the child quiet, as deep anaesthesia is dangerous to infants. Aromatic spirits of ammonia, one drachm to the ounce, should always be on hand in suitable dropper. The advantage of chloroform is that there is less mucus present to interfere with respiration and the operator and by its use the operation can be done more quickly.

The tongue should be grasped by suitable forceps or by a stout ligature, as traction on the tongue will be frequently required to improve respiration as well as to better enable the swabbing of the throat, and in these instances time is a factor.

Baby Number 3.

Represents protrusion of the premaxilary bone.

This type should be operated on at an age usually from ten days to three months.

Number 4. Age 12 years.

This is a type of cleft frequently found among the school children in our clinics.

Baby H. - - - - - - Age 4 months
Double harelip and cleft palate.

At 2½ years, mouth appears slightly contracted in picture but his mother states that his mouth is plenty large enough and would not consent to have the mucous membrane everted by a small incision at each corner of the mouth.

Resuscitation of Infants.

When there is a cessation of the respiratory movements and closed fauces, immediately withdraw anaesthetic and remove mouth gag. The child is taken by the feet and the occiput resting in the left hand, the child is raised as high as the operator's chest and then given a hasty downward motion as though throwing the child from you. This should be done several times. This causes the abdominal viscera to be forced against the diaphragm in which case the heart's action is stimulated. Before this is resorted to the chest may be gently compressed and then relaxed, so that the heart and lungs may be stimulated. These movements of artificial respiration should not be performed too rapidly, nor too energetically. Once in four seconds is sufficient.

Method of Operating on Uncomplicated Cases of Cleft of the Hard and Soft Palate in Adults.

After the patient is placed on the operating table and anaesthetized, the Brophy speculum or Ferguson mouth gag is put in place. The tongue is then secured by special forceps or by a ligature threaded to a stout needle and drawn through the tongue. This is held by the assistant or anaesthetist and the tongue drawn to one side. The muco-periosteum is then raised from the bone by curved periosteal elevators, preferably curved at right angles. The instrument is inserted at the border of the cleft and all the soft part eleveated, including the periosteum.

A long handled, thin bladed knife is thrust into the border of the cleft on either side, and a narrow paring removed the whole length of the palate. It is imperative that the margins of the cleft be thoroughly denuded or failure of union will result.

Having denuded the hard palate of the periosteum the next step will be to pare the edges of the cleft through the entire length of the soft palate as well as the soft parts from the hard palate, dividing also the membranes at the distal surfaces of the horizontal plates of the palate bones. These membranes cover also the nasal surface of the palate bones and extend down to form the superior distal surface of the soft palate. This done the soft parts fall together so that there is no necessity for making lateral incisions except in rare instances.

The splitting of the borders of the soft palate where the tissue is quite thick is often sufficient to secure perfect union, thereby avoiding the removal of tissue in this part of the palate which it is so necessary to save. After the edges of the cleft are freshened, a Deschamps needle is employed, with which to introduce the silk sutures, four of which are carried through the tissues. These are substituted by silver wire No. 22, American gauge. The lead plates No. 22, American gauge are

perforated, the holes corresponding to the number of sutures required, extend the whole length of the cleft and are shaped to conform to the palatine surface. The wire sutures are then passed through the holes in the lead plate and the wires twisted together. For convenience coaptation sutures may be introduced but not until tension has been exerted by the wire sutures and lead plates, upon the divided portions of the palate and the margins approximated. This done the coaptation sutures of horse hair are tied. The lead plates serve as splints thereby holding the palate more or less immovable until union has taken place.

Brophy says, "Should the palate not be of sufficient length to perform its functions this defect can be overcome by making use of the palato-pharyngeal muscles. Fully one-half of this muscle can be used for this purpose."

Many young adult patients are advised that nothing can be done for them in a surgical way. This is not true. There are many cases on record of successful cleft palate operations for adults, thirty and even forty years of age.

I believe that fasting for two or three days before operation is contraindicated, for the patient's vitality is likely to become impaired.

In operating on adults I have had some excellent results by the employment of intravenous anaesthesia, using a seven per cent. solution of ether in physiological saline. If necessary, up to two liters may be used with perfect safety. There are no disagreeable after effects and it is a great relief to know that there will be no retching or vomiting; and that the patient will sleep the greater part of the night following the operation. I believe that many otherwise successful operations may trace their failures to strain put on the palatal muscles, during the first forty-eight hours succeeding the operation, by retching, vomiting, etc.

I have lately operated on three adults by this method and obtained excellent results. They include three complete clefts of the hard and soft palate and I am so pleased with this form of anaesthesia that I will endeavor to use it wherever possible.

This method cannot be used on infants and children on account of the small calibre of the veins.

Radium in the Treatment of Cancer of the Mouth.

By Oscar H. Strauss, M.D., D.D.S., Milwaukee, Wis.

In considering this subject, I refer to all malignant lesions to which the mouth and adjacent parts are subject. Under this subject are included all forms of sarcomas, such as alveolar sarcoma, chloromatous sarcoma, melonotic sarcoma, osteoid sarcoma, serocystic sarcoma, periostial sarcoma, epulis or giant cell sarcoma, and osteo-sarcoma; epithelioma and leukoplakia in all its forms, including its degeneration into carcinoma; and the various types of carcinoma, such as glandular carcinoma, melonotic carcinoma, osteoid carcinoma, and scirrhous carcinoma are also included under cancer.

The character of the growth and extent of involvement are the first considerations. Then the patient's age, his general condition and the location of the tumor must be considered. The malignant growths which in the surgeons' minds were always considered the most serious, respond favorably to radium. Under this category we can include all the very vascular and rapidly growing tumors.

In neoplasms of the mouth or of the adjacent parts we must consider that fifty per cent. of the cases are inoperable. As soon as the growth or its metastasis has extended into the larynx or pharynx, the cancer in this region is practically inoperable, as the removal then requires such extensive resection.

Results of Radium Treatment.

Radium at present holds out the only hope possible in these cases, although the disease may be far advanced. It is astonishing how the growth will shrink by the use of hard gamma rays. Where the growth is far advanced we have no right to do what is known to us as "select our cases," for sometimes the most hopeless ones respond most quickly, but we cannot promise even in the smallest lesions a positive cure. I have many cases that were given only from three weeks to three months to live. With radium treatment the patients apparently have had a complete recovery and are in better condition now than they were at any time since the treatment was started. Over a year and a

half has elapsed since the treatment was begun. On the other hand, I have had cases in which there were no signs of the original tumor left and absolutely no metastasis for a period of three months, and within a few weeks the entire cervical lymphatics were involved and the disease extended down the carotid sheath into the pulmonary region. In spite of anything that could be done, the rapid development could not be checked.

In the type of cases which develop so rapidly, in my judgment the systemic condition is the stimulating factor. It is for this reason that we have to use systemic treatment before employing radium, and we certainly should always use the systemic treatment while we are using radium. This treatment consists of elimination and of improvement of the blood stream, particularly the lymphocytes.

If it is possible, the tumor should be removed surgically before radium is employed. This operation removes the danger of rapid metastasis, particularly in the region of the mouth where metastasis becomes a very serious matter.

Although radium will penetrate the entire body, the further the lesion is away from the surface the more difficult it becomes to reach, as more or less normal tissue will be destroyed. Cancerous tissue has one-tenth the power of resistance to radium rays that normal tissue has. After the tumor has been surgically removed, the radium is immediately employed on the entire area surrounding the tumor, so as to destroy all remaining malignant cells. In this way, practically a non-malignant condition is produced, which, however, requires a great deal of care and attention. Radium must be used in large enough quantities properly screened and in the right position to result in the actual cross-fire method at the point where it is most needed. If this result is not properly obtained, instead of necrosing the remaining cancer cells, we shall cause a stimulation. I have seen one of these cases where radium was employed for cancer of the tongue result in very serious consequences. Although only one-twentieth of the necessary dose was used to treat the patient, the stimulation caused by this small amount of radium was enormous. The metastasis spread within three weeks to the sublingual and sub-maxillary glands, and the entire floor of the mouth, pharynx and larynx became involved. Usually it would take five or six months for this extensive involvement even in very rapidly growing tumors. This danger is not alone in the use of radium, but also in all forms of medication, in cauterization, and in surgical interference. If a cancer is to be operated on, the operation must be performed thoroughly or not at all. If surgical methods are employed, only a complete removal should be made. If

cauterization is to be employed, the actual cautery is the only one to use, and this should be done in a most thorough manner. Nitrate of silver or any other chemical caustic should never be used on a cancer, nor should parts of it be cut away for microscopical examination. The greatest cause in developing a cancer is irritation. Any irritant, whether it be mechanical, chemical, or bacteriological, will help the development of a cancer to an enormous extent. Therefore, in treating a cancer, one of the first considerations is to eliminate all irritants.

Dental Aspect.

In eliminating the irritants of the mouth, the dentist can assist the surgeon or specialist and patient a great deal. The only favorable point about a supposed cancer in the oral cavity is that it is usually caused by a local irritant; consequently, many times before the epithelial whirls exist, and there is really no true epithelioma, the exciting cause can be removed, and then the growth which has as yet not become a true cancer can be removed. This removal of the exciting cause will then result in a permanent cure.

Where a true cancer is established, after all irritants have been removed, the tumor has been removed and the remaining cancer cells have been destroyed by radium, we shall also have a happy result. On the other hand, if the tumor is removed and the local irritant still remains, we shall have a new growth form of greater activity and violence than the one that has been removed.

Mechanical Exciting Causes of Cancer.

The existing cause of cancer of the mouth may be mechanical, chemical, or bacteriological. Among the mechanical irritants we should look for ill-fitting dentures improperly polished inlays and fillings; ragged teeth; roots; calcarious deposits; improperly occluding teeth; imperfect approximal spaces; use of pipes, cigars and cigarette holders, etc.

Chemical Irritants.

Among the chemical irritants, the greatest one is phenol found in tobacco smoke; nicotine from the tobacco; hyper-acidity of the saliva; foods containing chemical irritants; alcoholics; mouth washes; dentrifices containing chemical irritants, etc.

Bacteriological Causes.

Among the bacteriological causes, we may have any of the various non-virulent species of bacteria which may work into an abrasion or any traumatic condition of the mucous membrane and prevent healing; then the irritation caused by these bacteria prevents the proper granulating process and continues to irritate until a true epithelioma is estab-

lished. In considering the bacteriological irritants we should also inspire a differential diagnosis to determine whether the lesion is tubercular, leukemic, or diabetic, or if possible we should determine the predisposing causes. When this diagnosis has been determined, then all the other local irritants must be considered and must be removed. Some of the local conditions may be produced by a systemic condition, such as hyperchlohydia, tuberculosis, siphilis, mercurialism, etc., or by a focal infection at some other place, as in the nose or tonsils, in the pockets around the teeth, or by pyorrhea in its various forms.

After a thorough differential diagnosis has been established, which should be done only by a thorough physical and clinical examination, including urinalysis and blood and sputum examination, it is advisable to remove the tumor in the way mentioned. If the tumor is operable, surgical measures or actual cautery should be used; if the tumor is inoperable, or if the removal would produce a permanent deformity, such as the removal of the entire tongue, or the greater part of a cheek or lip, the entire mass should better be removed by radium. As soon as the tumor has been removed, whether by surgery or by cautery, radium should be employed immediately. The patient should not be advised to wait until another tumor or non-healing lesion has formed. The radium treatment should be started two days following the operation where it is possible to do so, and should be continued until all remaining malignant cells have been destroyed.

The technique of the use of radium should be thoroughly understood before radium is applied, and enough of the material should be on hand to do the work effiicently. As has been stated before, the application of too great an amount will destroy too much healthy tissue and do as much harm as the cancer does. This danger can be prevented to an extent by proper screening, even though the dose be too large.

X-Ray Contra-Indicated.

The X-ray should never be used, as the number of hard gamma-rays (the rays that destroy cancer cells) is too small to do good, and the alpha and beta rays of the X-ray are so very dangerous. We have seen many fatal results from this otherwise splendid instrument for diagnostic purposes.

In conclusion, allow me to call attention to the precancerous conditions, both systemic and local. Let me warn all here to remove at once all the conditions favorable to the development of this terrible and most dreaded of all diseases.

A Case of Acromegaly.

By Pehd Gadd, Helsingfors, Finland.

I.

Acromegaly, a form of disease which as is known is supposed to stand in the closest connection with the formation of tumors in the *hypophysis cerebri*, was described as a special disease in 1886 by Pierre Marie. Former descriptions, that of 1872 by V. Langers and that of 1884 by Fritsche and Klebs did not give a picture of a definitely well-formed type of disease.

The most marked symptoms are: an abnormal enlargement of certain peripheral parts of the body, the face, in particular the lower jaw, the hands and the feet, and this enlargement is specially localized in the bone system, regarding which Sternberg adds: a deepening of the cavities of the blood vessels, an enlargement of the vessel's foramina, a thickening of the ligaments for muscles and sinews, by which the bones get a larger appearance. The change consists more in an abnormal enlargement of normally occurring irregularities and protuberances than in actual new formations and exostoses.

Symptons in Acromegaly.

The most conspicuous changes arise certainly in the bones of the cranium the relatively least in the long tubular bones. By means of Roentgen photographs it has further been established that the growth of the hands and the feet depends more on an increase of the volume of the soft parts than on an enlargement of the bone. With regard to the enlargement of the head, especially the face, the soft parts have their share even here to a considerable degree; thus the nose, which grows to all dimensions; the lips, especially the lower lip which becomes large and protruding, and above all the tongue, which "has scarcely room in the mouth, in consequence of which the mouth often remains open." By no means seldom does exophthalinus appear, as well as different forms of defects of vision, partly hernianopsy, anblyopsy as a result of atrophy of the optics, etc., enlargement and thickening of the eyelids as well as kyphosis and some scoliosis.

PLATE I.

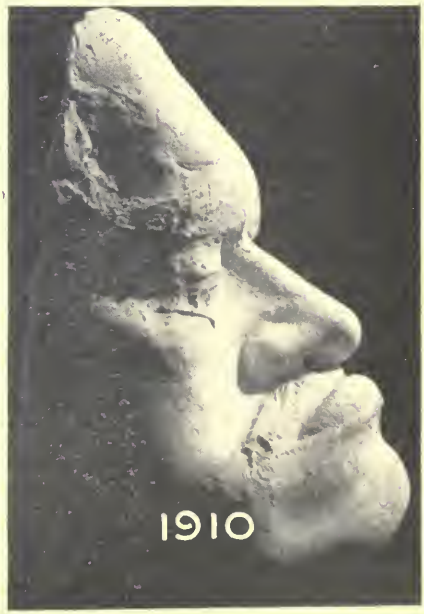


PLATE II.

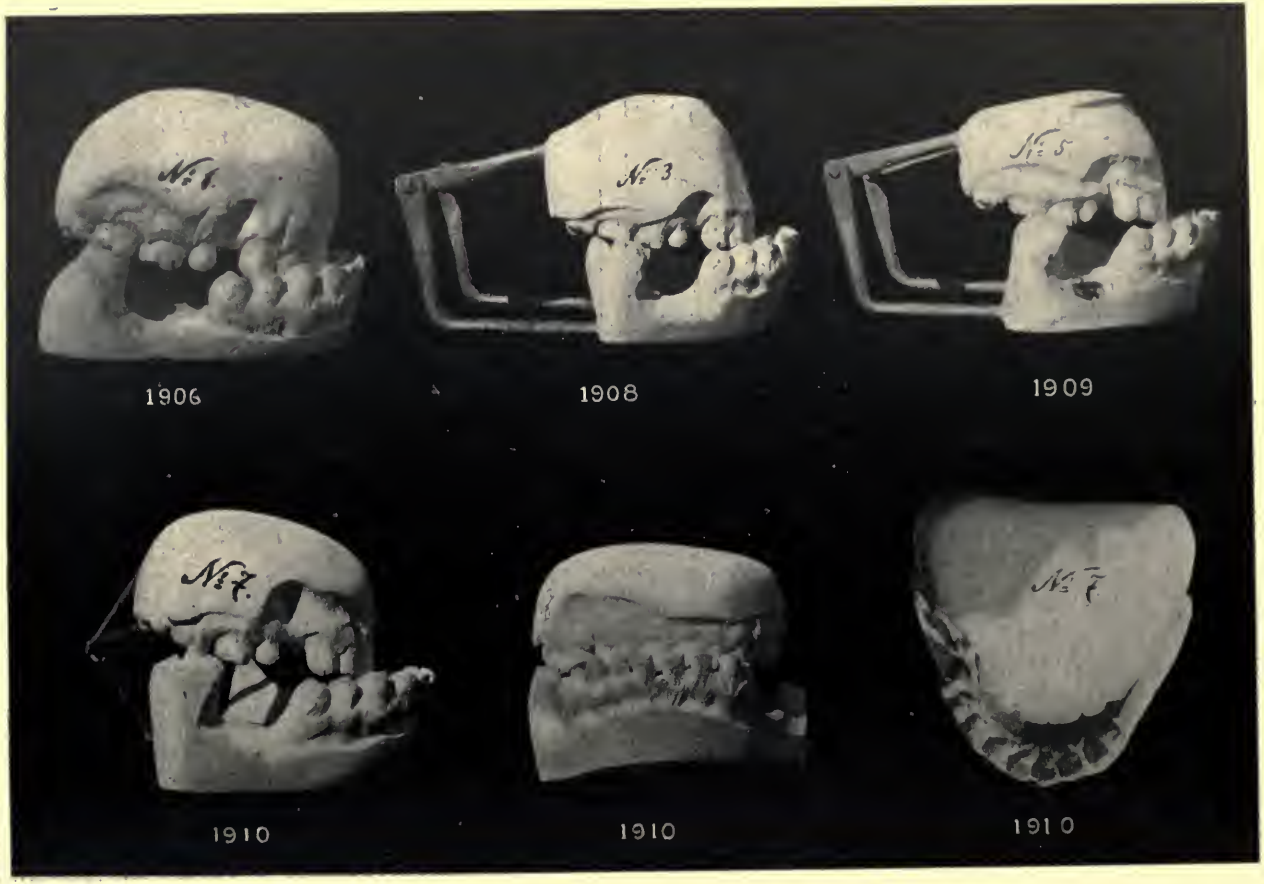


PLATE III.

Among subjective symptoms may specially be mentioned: loss of sexual instinct, polyphagia, polydipsia, as well as sometimes headache, palpitation of the heart, difficulty in breathing, paræsthesia, and pains in the extremities and vasamobor neuroses.

With regard to the diseased changes in the mouth and jaws Sternberg emphasizes the pneumatic holes, especially the *antrum Highmori* as being considerably widened, with the walls very much thinned. The *arcus gygomaticus* appears thickened, very strongly arched. They can even hypertrophy the alveolar process ot the upper jaw, so that the whole cheek appears to protrude to a considerable extent. The lower jaw again hypertrophies over its whole length and often displays enormous dimensions. Its alveolar process overlaps that of the upper jaw even in the curved portion. As a result of this the masticatory surfaces of the teeth are entirely displaced. In more advanced stages of the disease all the teeth of the lower jaw bite entirely past those of the upper jaw. By reason of the diseased growth of the jaw, derangements in the alveoli of the teeth often take place, so that the teeth become quite loose and sometimes even fall out. Single teeth man turn on their axis to the extent of ninety degrees. As a result of the hypertrophy of the jaws, especially the lower jaw, a very pronounced deformation arises, a displacement beyond the vertical plane of the forehead. Besides, there is often noticed, if the teeth are still remaining, a so-called *alveolar prognati,* which is shown by the alveolar processes of both jaws bending outward. The protruding position of the lower jaw may partly be caused by a kind of subluxation in the joint of the jaw which could be brought about by an enlargement of the *cavitas glenoidalis* and also by the *tuberculum articulari,* atrophying gradually and disappearing. The abnormal appearance of the yoke bone in conjunction with the colossal size and protruding position of the jaws naturally distorts very considerably the facial expression and gives rise to the long, oval and yet clumsy face which is so characteristic of a person suffering from acromegaly.

The mucous skin of the cavity of the mouth shows a considerable thickening. The tongue is often enormous, seven to eight cm. and more in breadth. Its size depends partly on an increase of the intermuscular connective tissue; partly on thickening of the mucous skin, by which its papillæ increase enormously both in length and in breadth. The tongue is therefore a typical *lingua plicata, "Faltenzunge,"* the French *"langue scrotale."* Its musculation often shows the most varied forms of atrophy and degeneration. The mucous skin of the soft palate is often considerably thickened, and the lymphatic glands of the throat are not inconsiderably enlarged. Often the hypertrophy of the mucous skin is so great

that the mucous membrane on the border between the hand and soft palate hangs down into the cavity of the mouth in the form of a fold resembling a tumor. The size of the tongue is often for the patient a considerable obstacle in speaking and chewing. Derangements in the sense of taste appear to be not entirely uncommon.

Case History.

I take the liberty of giving the following particulars from a patient's medical history*: Patient, A. J. S., Doctor of Philosophy, docent in Zoölogy in the University of Helsingfors, Finland, is thirty-one years of age. The father died of inflammation of the brain at the age of fifty years. The mother and a full-grown sister are alive and well. The patient's only brother died at the age of four months.

As a child, patient was small and thin and suffered from convulsions during the first years of his life. During the years of adolescence he was comparatively delicate but on the whole healthy. As the photographs from 1892 and 1896 show, he was at the ages of fourteen and eighteen respectively, slender with finely cut features.

When patient was twenty years old (1898) a gradually perceptible growth of body began. The width of his chest and body weight increased considerably. The head became larger; the supraorbital regions and the *protuberantia occipitalis externa* became very prominent; the lower jaw increased in all dimensions and began especially to protrude considerably; at the same time the distance between the front teeth was increased; the nose and lips became thick and plump and the tongue also increased in size. The hands and feet became broad and thick. A hyphosis was formed.

In 1900 curious attacks, reminding one of epileptic absences began to occur and these continued during the whole course of the disease; later on more violent attacks of epileptic form also occurred. In 1901 neuralgic pains localized to the right side of the neck and the region round the right eye occurred. On the other hand there was no headache and no defect of vision. From the year 1900 the sexual functions began to weaken and gradually to disappear entirely. During all that time the psychic functions remained until the last almost entirely intact; even during the last years the patient was able to produce very important scientific works. Roentgen photographs showed a distension of the *sella turcica* and an enlargement of the *dorsum sellæ*. An operation was performed in 1910, but could only show the existence of a diffuse inoperable tumor. Death followed shortly after the operation. The post mortem examination showed an extensive, quite firm hypophysical tumor which had destroyed the sphenoid and grown over into the right *forea media cranii*.

*Partly from Krogius.

Epicrisis. The exterior transformation of the body and especially of its "acral" parts was in this case so typical of acromegaly that the diagnosis was obvious. On the other hand ophthalinic symptoms and headache were entirely wanting. Instead, often repeated attacks reminding one of epileptic absences and more violent attacks of epileptic form as well as severe neuralgia localized to the right side of the neck and the region round the right eye played an important rôle in the picture of the disease. The former have indeed not seldom been observed as a bi-phenomenon in acromegaly; on the other hand neuralgia of the type in this case, has, as far as my knowledge of the literature goes, not been described in connection with this disease. Finally I cannot refrain from emphasizing as a remarkable circumstance patient's keen and active intelligence which was maintained until the very last. *"Der Kranke ist,"* says Oppenheim in his description of acromegaly, *"apatisch, energielos, schlafsüchtig."* There was no trace of such in this case. Patient indeed made a depressing impression, but his bodily sufferings did not prevent him from studying and giving instruction with great energy and even during the last year from making himself competent at an early age for a chair in zoölogy by means of a series of scientific works of high rank.

II.

Let us now turn to the position of patient's jaw and teeth. As is apparent from the plaster cast models reproduced herewith, there has been a continuous and gradually progressing growth of patient's lower jaw. In this connection the question arises: "What normal sizes can patient's jaws originally be considered to have had before the breaking out of the disease at the time when their normal growth had reached its completion?"

In order to answer this question I have, as will appear from the following, endeavored to bring back the upper jaw to a "normal" one with the help of the exact measurements and methods of calculation which are found in the literature quoted, in order in this way to be able to show in what way the disease had deformed the same. Along with these "normal measurements" the plaster cast models of patient's jaws should give a picture of the successive growth of the lower jaw in as correct a light as possible.

Unfortunately I did not have an opportunity of taking an impression of patient's palate, and position of the teeth, every half year, as was first intended. The seven impressions which are before us were taken:

No. 1 in April 1906
No. 2 in June 1907
No. 3 in April 1908
No. 4 in Oct. 1908
No. 5 in May 1909
No. 6 in Sept. 1909
No. 7 in May 1910

The facial mask is from an impression made March, 1910, about two months before patient's death.

The figures for the different dimensions of the palate—length, breadth and height—occurring in the literature consulted are often obtained by quite different means. Some writers (Körner, Waldow, Schaus and others) took plaster casts of their patients' palates, which casts they afterwards measured and compared with each other. The large majority of young writers again measure directly on the patient the dimensions of the palate and then calculated from them a so-called index. Considering that absolute measurements do not play the part former writers ascribed to them, these latter writers place as a basis for a comparison between different palates the relation between their dimensions, which relationship can be expressed by a number—an index. Further a number of series of direct measurements of craniums is found in the literature consulted. Such measurements have been carried out in Finland to a very large extent by Prof. K. Hällsten. Unfortunately results gained by direct measurements of craniums cannot at once be compared with those gained by plaster casts of the palates of living individuals without taking into consideration the influence which the thickness of the mucous membrane must exercise on the result in figures in every separate case, irrespective of the circumstance that it has been usual in such measurements to compare not only the absolute size of the palate but also its indices.

Finally there are so to say purely odontological methods (Pent, Hawley, Gysi and others) whose advocates calculate the width of the curve of the jaw by the help of the dimensions in the breadth of the upper front teeth.

In measuring the palate the height as well as the length and breadth is taken into consideration, as already stated. Elmgren measures the breadth of the palate direct at premolar II; Alkan again from a point between premolar II and molar I*. Both calculate the height in the same way. They measure the distance from the alveolar edge on the lingual side of the tooth to raphe, first on the one side and then on the opposite and calculate the height of the palate with the help of the width of the palate which barely makes the base of the triangle.

From the measurements of height, breadth and length, the height index and length index are then calculated according to the formula:

$$\text{Height index} = \frac{100 \text{ height}}{\text{breadth}}$$

$$\text{Length index} = \frac{100 \text{ breadth}}{\text{length}}$$

*Alkan measures, more exactly, the breadth at two places, between both premolars and between both molars on the one side to corresponding points on the other side.

With regard to the influence of age on the height and breadth of the palate, Bentzen states that the absolute height of the palate increases until the twenty-fifth year, after which it begins to decrease, while the breadth increases throughout all the classes of age observed by B. The breadth is said to increase mostly after the change of teeth, the height mostly after puberty.

Elmgren has arrived at the conviction that the height of the palate increases up to the nineteenth year, the last year of age which his investigations embrace. With regard to the breadth again, Elmgren's investigations show that it does not increase after the fifteenth year. Finally the length increases during the whole period of adolescence.

Elmgren further states on the basis of exhaustive and laborious measurements that the formation of the face acts on the formation of the palate in such a way that chamæprosopics have a lower and longer palate than leptoprosopics who have a comparatively high and short palate, all this in cases which are described as normal. Liebenmann came (1897) to the same result in the main in that he held leptoprosopics as representatives of high—chamæprosopics of low palates.

Schwartz's investigations again have clearly demonstrated that the circumstances of the form of the palate are not influenced by but are entirely independent of the form of the cranium even though previous writers had come to a somewhat different result.

I give here in the annexed table the figures in mm. by which the sizes of patient's different jaw dimensions exceed the sizes which Elmgren found to constitute the average for the nineteenth year, the highest his investigations embrace as well as corresponding figures for that of Merkel's periods (the third) which refers to the years from fifteen—twenty.* Of Elmgren's material I have only used the measurements which embrace the form of the palate which has been called normal (cases without either septum deviations or adenoid vegetation). About this form of palate, Elmgren remarks that there is no constant value for the height, breadth or length of the palate, neither is there any constant height or length index for the year of age, basing his opinion on material collected from 1,231 measured persons, 873 leptoprosopic and

*According to Merkel the growth of the cranium would continue during two periods separated from each other by a period of almost complete standstill. The first period would last from birth to about the seventh year, after which there would be a period of standstill until the beginning of puberty (fourteenth year) when a new period of growth would begin.

358 chamæprosopic.* In the table the patient's measurement in each separate case has been calculated according to the system the respective authors have used.

Schauss has measured a number of casts of palates taken from his practice, by which he found that the normal cases (cases without septum deviation) at molar II have an average height of 1.8 mm. The average breadth in those same patients was at bicuspid I, 32 mm., at molar II, 39 mm. As table I shows, patient's corresponding measurement exceeds Schauss' average figure by 4.9 (27.2%) resp. 9.6 (24.6%) mm.

Alkan, who has carried out his measurements directly on patients, has come to a certain average figure for the height and length index of the palate in persons *"mit normalem Gaumen,"* which indices he designates as the normal value. For children (between three and fourteen years of age) the normal length index would therefore be 43.5, for adults 45.7. The corresponding normal height index would be for children 73.3, for adults 69.1. That even these figures are relative and considerably subject to individual variations appears clearly from the excerpt from Alkan's tables on *"Erwachsene mit normalem Gaumen."* The lowest limit of age is, as appears, seventeen years, the highest twenty-four.

Patient's corresponding length index of the palate is 65.4, height index 57.9. See table I.

Hallsten's Methods of Measurement.

I give further as material for comparison excerpts from a series of palate measurements made on craniums found in different parts of Finland. The measurements have been carried out and published by Prof. K. Hällsten and all are ascribed to the well-known system of the Frenchman, Broca. Hällsten measures the breadth of the palate from the broadest part between the molars, wherever it fails. We ought never to leave out of account the fact that we here have to deal with cranium measurements which cannot be directly compared with corresponding measurements taken on the living person

*With regard to the formation of the face the *"Frankfurter Kraniometrische Verstandigung"* in 1884 laid down that a facial height index of 50.1 upwards would denote a leptoprosopic formation of face and an index of 50 and lower a chamæprosopic type; this when index $\left\{\frac{100 \times \text{facial height}}{\text{facial breadth}}\right\}$ is calculated from the *Obergesichtshöhe* (from the middle of the sut. naso-front. to the lower edge of the proc. alveol. sup. between the central incisors). Should again the height index of the face be calculated from the proper *Gesichtshöhe* (from the sutura naso-front, in living persons the root of the nose, "nasion" to the middle of the lower edge of the lower jaw, in living persons the middle of the lower edge of the chin), 90 makes the border between chamæprosopics and leptoprosopics. The breadth of the face again is measured across the greatest breadth between both processus sygomatici. The patient's facial index is 47.85 resp. 84.29.

or on plaster cast. The influence the thickness of the mucous membrane exerts must therefore be taken into consideration in a comparison of each separate case even though the patient's measurements are taken with the exercise of the greatest possible pressure. As table I shows, patient's breadth of palate exceeds by 13.0 mm. (35.5%) and length of palate by 9.6 mm. (18.9%) Hällsten's corresponding average figure (the average figure of fifty-one measured craniums).

Patient's absolute palate measurements:

Length	Model	Breadth
....	No. I	50.6 mm.
....	No. II	51.0 mm.
58.5 mm.	No. III	50.9 mm.
58.9 mm.	No. IV	50.2 mm.
58.9 mm.	No. V	50.0 mm.
....	No. VI	49.8 (50.0) mm.
59.6 mm.	No. VII	49.8 mm.

Pont's Method.

Pont, in Lyons, has set forth a method for calculating the mutual distance in the upper jaw of, on the one hand, the front bicuspids on the other hand, the six years molars. On the basis of many measurements according to anthropological pattern. Pont believed that he had found certain indices for those distances, indices which are dependent of (vary in proportion with) the state of breadth of the upper incisors. By exactly measuring on the patient the breadth of the four upper incisors, Pont considers that by a simple calculation the deviations from the normal "breadth of jaw" can be fixed in every phase of development. If I have rightly understood Körbitz's* exceedingly brief and in many places vague account of the method, Pont would first calculate the total of the breadth dimensions of the four upper incisors. He then multiplies the total by $\frac{10}{8}$ to get the mutual distance of the bicuspids; by $\frac{10}{6}$ to get that of the molars.** These distances appear, to judge by the annexed plate (with scale attached), to be calculated for bicuspids from the middle of the sulcus on the masticatory surface of the tooth, for the molars, from the point on the tooth where the anteropalatinal and the border surfaces of both buccal protuberances meet.

*Körbitz does not give the source, which I unfortunately have not succeeded in obtaining.

**Die genauen Zahlen sind $\frac{100}{78\text{-}82}$ bezu. $\frac{100}{60\text{-}65}$ Körbitz states in a note without saying in any way how these exact values are got.

The mutual distance of the bicuspids $= \frac{10.S}{8}$

The mutual distance of the molars $= \frac{10.S}{6}$

where S is the total of the breadth dimensions of the four upper incisors.

With the patient in question the calculation is as follows:

Left		Right	Corner Tooth	
9.33 mm.	Large I	9.0 mm.	L.	R.
6.9 mm.	Small I	6.7 mm.	8.2	8
6.7 mm.		6.66 mm.	8.2	8
11.5 mm.	six years molar (below)	11.33 mm.	8.1	
11.4 mm.				

$$S=6.8+9.3+9.0+6.7=31.8$$

The calculated mutual distance of the bicuspids $\frac{31.8 \times 10}{8} = 39.75$ mm.

The corresponding actual mutual distance of the bicuspids* on

Model I	Model II	Model III	Model IV
42.3 mm.	42.3 mm.	42.3 mm.	42.5 mm.

Model V	Model VI	Model VII
43.3 mm.	43.3 mm.	45.8 mm.

The corresponding actual mutual distance of the molars on

Model I	Model II	Model III	Model IV
56.6 mm.	56.6 mm.	57.4 mm.	57.4 mm.

Model V	Model VI	Model VII
57.4 mm.	57.8 mm.	59.4 mm.

Bonwill's Method.

Bonwill's method, revised and elaborated by Hawley, gives us even the possibility of calculating the normal and more correctly ideal curve of the jaw by the help of he collective breadth dimensions of the front teeth—here the central, lateral and cuspid. Hawley's *schemata,* which give the average figure of about one hundred measured "typical jaws," allow us to carry out this calculation in those cases where only one or two of the permanent teeth have erupted. As is known, Bonwill, practically taken, places the distance from the central's medial edge to the cuspid's lateral** as the basis for a very complicated geometrical figure whose well-known construction must be presupposed as known to every dentist. The resultant curve line gives according to Bonwill, Black and Hawley the most ideal jaw curve, along which one, either by marking out the breadth measurement of the bicuspids and

*Not quite reliable values as the first bicuspid on the right is missing.

**Properly the collective breadth of the central, lateral and cuspid.

molars in those cases where the bicuspids have come forth or by a geometrically constructed and accurately determined transveral axis can measure the width of the jaw and compare it with the corresponding width of jaw in the cavity of the mouth. In our case the construction is as follows:

Breadth of Central		Breadth of Lateral		Breadth of Cuspid	
L.	R.	L.	R.	L.	R.
9.33 mm.	9.0 mm.	6.9 mm.	6.66 mm.	8.2 mm.	8.0 mm.
		6.7 mm.	6.7 mm.	8.2 mm.	8.0 mm.

Average breadth for Central—9.16 mm.
Average breadth for Lateral—6.7 mm.
Average breadth for Cuspid—8.1 mm.

$$r=9.16+6.7+8.1=23.96 \text{ mm.}$$

The mutual distance of the six years molars, calculated according to Hawley is 44.2 (44.4) mm. from the one's mediolingual protuberance to the other's corresponding protuberance.

The corresponding actual distance calculated from the casts which are of patient's jaws, are:

Model I	Model II	Model III	Model IV
48.5 mm.	48.5 mm.	49 mm.	49 mm.

Model V	Model VI	Model VII
49.5 mm.	50.8 mm.	51.5 mm.

See table I.

Camper's Method

I have been endeavored to calculate the Camper* facial angle given in the majority of craniological measurements, as through the kindness of Prof. Hj. Grönroos I succeeded in obtaining an apparatus constructed by Broca for that purpose, even though the value of the angle as a measurer of jaw prognathy can be questioned. According to Camper himself the angle was originally only intended for a help in the study of human races and their prognathy. With regard to the lines of limitation of the angle, there have been different opinions; but Camper himself appears generally to have allowed it to be limited by a facial line from the most prominent part of the forehead to the anterior edge of the alveolar process of the upper jaw and by a basal line from the spina nasatis anterior to the upper edge of the meatus auditorius externus. The angle is, as is clearly seen from the literature consulted, very variable. According to G. Retzius it varies in the craniums of Swedish persons between 67° and 75°.** without being able to give re-

*The well-known Dutch anatomist of 1770.

**Max. in animals (orangutang) 58°. Usually between 40° and 50°.

liably the actual prognathy, owing to the fact that the protruding of the forehead is decisive for the one leg of the angle and thereby to a considerable degree for its size.

As little as the Camper angle, can other cranium angles (Huxley's, Thering's, Welber's and others) be considered as able to give the actual prognathy in that they are all subject to such large individual changes that there can hardly be found in them some circumstances in the least degree constant. As regards Finnish persons the Camper angle is usually 73° to 74°, while in the patient in question I found it to be 64°, measured with Broca's instrument and about 65° measured according to Matieu. It is therefore seen with desirable clearness that the angle with regard to the patient in question is abnormally small, under the minimum given in the literature consulted by 1° to 2°, as more than about 1° can not well be ascribed to faulty observation.

The Teeth in Acromegaly.

And the teeth! How are they? The information given in the literature consulted as far as I could find, is very scanty in this connection. As far as I know, only Rose has published more exhaustive measurements of the size of the teeth, breadth of the palate and the type of face which are founded on such a broad basis as to justify certain general conclusions. I cannot deny myself the pleasure of giving one of Rose's final tables of average figures as material for comparison.

As is known, Rose has succeeded in demonstrating that *"Langgesichter"* have the largest teeth and at the same time the least breadth of palate. The broader the face is, the smaller the teeth and the broader the palate.

The Relation between the Form of Face, Size of Teeth and Breadth of Palate.

(Measurements carried out by Dr. C. Rose, comprising 98 soldiers of the Horse Life Guards, Stockholm, Sweden.) (Average facial index 87.3.)

Form of Face	Number examined	Breadth of Centrals	Breadth of Lower six years molars	Breadth of palate between six years molars
Langgesichter mit Index über.. 90.0	28	8.46	10.52	39.0
Mittelgesichter mit Index über. 85-89.9	33	8.38	10.33	40.4
Breitgesichter mit Index über..80-84.9	33	8.30	10.32	40.1
mit Index über..75-79.9	4	8.04	10.26	40.0
All soldiers	98	8.36	10.36	40.1

Patients corresponding measurements are:

Facial form Index		Breath of palate between the upper six years molars	Breath of Central L.	Breath of Central R.	Breath of Lateral L.	Breath of Lateral R.	Breath of lower six years molars L.	Breath of lower six years molars R.
	I	41.4	9.3	9	6.7	6.7	11.4 mm.	11.33 mm.
84.29	II	41.6			6.9	6.66	11.5 mm.	
(according	III	42.5						
to unreduced	IV	42.5						
measure-	V	42.8						
ment)	VI	43.2						
	VII	43.5						

As we see from his table Rose gives as the maximum breadth (largest average figure) for the central 8.4 mm. In patient we find the corresponding breadth is 9 to 9.3 mm. For the six years molar we find in patient the figure 11.4 as against Rose's maximum 10.5 mm.

From the above an acromegalous upper jaw and the deviation of its teeth from normal conditions may be considered to have been illustrated as far as possible, but how are the conditions in the lower jaw?

As an introduction it may be here emphasized that in the winter 1891-1892, therefore, shortly before the appearance of the disease, patient could be considered to be orthognathic even if he was able to allow the front teeth of the lower jaw to pass beyond those of the upper jaw when chewing. At the end of 1898, patient showed complete prognathy. Once this commenced it developed rapidly to end in the enormous deformation shown in Model VII. See Plate III.

Before we pass on to compare the lower jaw and its teeth with those of the upper jaw, we shall make a few remarks on Tables I and II which give an idea of the enormous growth, respecting the protruding of the lower jaw and the deformation resultant therefrom.

The distance between the most outstanding points of the condyles is in patient 156 mm. against the maximum given in the works consulted 135 and average 120.5 (see table II). The distance between the back angles of the lower jaw is again 129 mm. (latest measurement 132). The works consulted give as a maximum 119, (patient 128) as average 102.9 mm. From the last named angle to the condyle we have in patient over 90 mm. which fact, compared with the maximum of 72 and average of 58.4 in the works consulted gives a good picture of the colossal height of the mandible. With regard again to its "length," we find the figure 122 mm. representing the distance from the back angle of the lower jaw to the head of the jaw. This value exceeds the maximum given in the works consulted by 19 mm. The average shows only 91.7 mm. This

growth in the horizontal plane will appear still clearer in a comparison with the uper jaw, about which later.

If we finally measure the size of the lower jaw, the tape measurement from the one angle of the lower jaw to the other along the lower edge of the mandible, we get the figure 296 in mm. What this means appears from the corresponding maximum given in the literature consulted which only mentions 220 mm. with an average of 194.8 mm. The above given measurements are not fully comparable—we must remember that patient's measurements, although taken with the exercise of the greatest possible pressure, are compared with measurements taken directly on skulls.

I have also endeavored to measure the back angle of the lower jaw with Broca's instrument constructed for that purpose. The difficulty of measuring on living material is in this case very great; the instrument is, as is known, intended for craniological measurements. As an average value for my repeated measurements of the angle I finally fixed 129°. The maximum given in the literature consulted is 138°, the average value 122.9°

The height of the lower jaw in the sagittal plane is 40 mm. (the distance from the tip of the chin to the alveolar edge between the central incisors).

Some more measurements in order to render clearer the picture of the abnormal size of the lower face, in relation with the lower jaw.

The upper alveolar radius, according to Broca, the radius measurement from the middle of the aural openings to the upper alveolar edge is in patient 114 mm. as against the maximum III given in the literature consulted (average value 100.7). The lower alveolar radius, the corresponding radius measurement to the lower alveolar edge, is 129 mm. as against a maximum of 119 (average value 106.1). The mental radius, the radius measurement to the chin—specially decisive for us in this connection—reaches 162 mm. The corresponding maximum given in the literature consulted is only 135 mm. (average value 123.1). The tape measurement from the middle of the auditory canal to the tip of the chin I found between 192 and 200 mm. See table I.

The height of the face from the root of the nose to the chin is 118 mm. The maximum in the literature consulted is 131 mm.; the average 116.1. Finally the facial diagonal from the root of the nose to the back angle of the lower jaw shows 139 mm. as against a maximum of 143 and an average of 130.2 mm.

I take the liberty to remind my readers that all these measurements given in the works consulted have reference to living normal individuals (Finnish persons).

In order to get a final picture of the growth of the lower jaw, resp. the protruding of its teeth, we shall in conclusion allude to Table II, which shows the gradually increasing deformation such as it appears from the plaster casts of patient's set of teeth.*

I call to your mind the fact that patient's teeth in the lower jaw in the curve comprise those of the upper jaw—the wisdom tooth to a certain degree excepted.

As the table shows, the mutual distance of the corner teeth of the lower jaw has increased by 2.5 mm. during the time covered by the casts of the jaw (from April, 1906 to May, 1910); the mutual distance of the anterior bicuspids again by 3.4 mm. Both these cross axes have increased somewhat similarly. The distance from the lower wisdom tooth to the lower central incisor on the opposite side has increased by 4.2 mm. If we examine the displacement in the sagittal plane between the biting surfaces of the upper and lower incisors, we find the difference is 7.4 mm. in other words the distance has increased by 77.08%, therefore, by more than ¾ of the distance at the commencement of observation. The displacement in the sagittal plane is further made clearly the growth which the distances from the upper six years molar to the lower central incisor on the opposite side as well as to the cusp of the corner tooth on the same side show. In the former case we note a growth of 7.6 mm. on the left side, and of 7 mm. on the right side. In the latter case again the increase in length is on the left 6.8 mm., on the right 4.4 mm. The difference between the condition on the left and on the right sides is to be explained that the lower jaw has "slipped" somewhat to the right, which even appears from the 6th and 7th paragraphs in the table. The distances between the upper corner tooth and the lower, in relation with the lower anterior bicuspid (on the same side) decrease in some degree on the right side in the three last models, at the same time as the corresponding measurements increase on the right side. The explanation of this is in my opinion obvious. The only remaining molar in the lower jaw (the wisdom tooth to the right) which alone bears the whole of the bite, has been gradually shifted by the growth of the jaw beyond the teeth in the upper jaw "articulating" against it (7+ and partly 6+) in consequence whereof on every biting together a pressure arose which partly shifted the tooth, partly strove to turn the lower jaw out of its normal path and which pressure thus gradually acted upon the point of the jaw itself.

In order to facilitate mastication to some degree, and if only slightly,

*As appears from the figures on plate II, there remain of patient's masticators in the lower jaw to the left only bicusp. I, to the right bicusp. I and II and the wisdom tooth. Above bicusp. I has been extracted.

heighten the bite and thereby apportion the masticatory pressure, I proposed to patient in the spring of 1908, a removable prothesis for the lower jaw. This was made and acted satisfactorily for half a year, when by reason of the constantly increasing process of deformation it had to be reconstructed in order to serve its purpose. After a time the prothesis had to be made afresh. This condition of things continued until patient's death.

Literature Consulted.

ALKAN, LOUS: Gewisse Formen des harten Gaumens und ihre Entstehung (Archiv für Laryngologie, Bd. X).

BENTZEN, S.: Archiv für Laryngologle and Rhinologie Bd. XIV, H. G.

BROCA, PAUL: Instructions craniologigues et craniometrigues, Paris, 1875.

BROCA, PAUL: Instructions generales pour les recherches, antropologigues a faire sur les vivants, Paris, 1879.

DENIKER: Les races europeannes (Bullet. de la Societed Antropol, 1897).

ELMGREN, AUG.: Undersohningar opez etiologin for s. k. hog gorn. Helsingfors, 1904.

FRANKEL, E.: Der abnorme Hochstand des Gaumens in seiner Bezichung zur Septumdeviation und zur Hypertrophie der Rachendachtonsille, Busel, 1896.

GADD, MAGNAS: Ivanne fall af akromegali, iakt Tagua a kommunala sjukhusat i Wiborg (Finska Lakaresallskapats Handlingar, Bd. XLIV, 1902).

HAGELSTAM, F.: Finska Lakaresallskapats Handlingar, juli, 1896. Ett fall af akromegali.

HAWLEY, C. A.: An accurate method in Orthodontia (ITEMS OF INTEREST, Vol. XXVIII, No. 12, December, 1906).

HOLSTI, H.: Ttt fall af akromegali (Festskrift fran pathologisk-anatomiska institutæ i Helsingfors 1890 (Zeitschr, für klin. medicia Bd. XX).

HALLSTEN, K.: Materiam pour servir a la connaissance des cranes des peuples germanigues trouves en Finlande (Bidrag till Kannedom of Finlands Natur och Folk, Helsingfors, 1892).

HALLSTEN, K.: Materiam pour servir a la connaissance des cranes des peuples finnois (Bidrag till Kannedom of Finlands Natur och Folk, Helsingfors 1881, 1885 och 1893).

KROGINS, ALI.: Ett fall af akromegali jamte nagra ord our den

kirurgiska Cohandlingen af hypophysistumorer (Finska Lakaresall skapets Handlingar, Bd. LIII, No. 7).

KORBITZ, ALFRED: Kursus der Orthodontia, Berlin, 1909.

MANDEL: Ein Fall von Akromegalie (Berliner klin. Wochenschrift 1895).

MERKEL, FR.: Beitrag zur Kenntniss der postem Cryonalen Entwichlung des manschlichan Schadels, 1882.

OBERNDORFFER, ERNST: Ueber den Stoffwechsel Cei Akromegalie (Zeitschr. für klinische Medicin Bd. 65, 1908).

RETZINS, GUSTAF: Materiam pour servir a la connaissance des caracteres ethigues des Races finnoises, Stockholm, 1874 (Comptes rendus du condres d'anthropologie et d'archeologie prehistorigue).

RETZINS, GUSTAF: Hvad har studiet of mannisko racernas hufonds-kalsbildning hittits untrattatsch hvad torde vi narmast hapa att vanta af denna forskning. (Antropologisk tidskrift, Bd. I, No. 2, Stockholm, 1874.)

RETZINS, GUSTAF: Finska kranier, Stockholm, 1878.

ROSE, C.: Beitrage zur europaischen Rassenkunde und die Beziehung zwischen Rasse und Zahn verderbnis (Archiv für Rassen-und Gesell-schafts-Biologie, 1905-1906).

ROSE, C.: Ueber die Rüchbildung der seitlichen Schneidezahne des Oberkiefers und der Weisheitszahne im menschlichen Gebisse (Deutsche Monatsschrift für Zahnheilkunde, Mai, 1906).

SCHAUS: Archiv für klin. Chirurgie, Bd. 35.

SCHWARTZ, W.: Ueber die Bezichung zwischen Schadelform, Gaumenwolbung und Hyperplasie der Rachenmandel (Zeitschrift für Ohrenheilkunde, Bd. 30, 1897).

STERNBERG, M.: Die Akromegalie (Monatschrift für Zahnheilkunde, 1898).

STERNBERG, M.: Zur Kenntniss der Akromegalie (Zeitschrift für klin. medicin, Bd. XXVII, 1905).

UNVERRICHT: Akromegalie und Trauma (Müncher med. Wochen-schrift, 1895, No. 14).

WESTERLUND, F. W.: Studier i Finlands-antropologie III, Hufondets form. (Fennia No. 20, 1902-1903.)

WESTERLUND, F. W.: Antropologiska uppgifter on Finlands Cofolkning (Atlas ofner Finland, 1910).

A Case of Acromegaly. Table I.

Patient's facial index 84.29 resp. 47.85; age 31 years
died May 19, 1910

																		Index Average
May, 1910	exceeding	by	2.1	mm.	(3.7	%)	Elmgren's	corresp.	average	length;	6	individuals	of	19	years			47.09
Length of Palate	"	"	2.5	"	(4.4	%)	Merkel's	"	"	"	106	"		15-20	"			50.0
(Model VII)	"	"	5.8	"	(10.7	%)	Alkan's	"	"	"	190	"		17-24	"			45.7
Index 65.4	"	"	9.6	"	(18.9	%)	Hallsten's	"	"	"	51	*Craniums*						
	exceeding	by	11.5	mm.	(41.8	%)	Elmgren's	corresp.	average	breadth at	Prm. II;	6	individuals	of	19	years		
	"	"	10.7	"	(37	%)	Merkel's	"	"	"	"	"	"	106	"	15-20	"	
	"	"	9.6	"	(24.6	%)	Schau's	"	"	"	" Molar II							
May, 1910	"	"	8.7	"	(25	%)	Alkan's	"	"	"	btw. Prm. I-II;	190	"		17-24	"		
Breadth of Palate	"	"	13.0	"	(35.3	%)	Hallsten's	"	"	"		51	*Craniums*					
(Model VII)	"	"	6.4	"	(12.07	%)	Pont's	calculated	average	breadth	of palate	at	Molar I					
	"	"	7.3	"	(16.5	%)	Hawley's	"	"	"	"	"	"	"	"			
	"	"	3.4	"	(8.5	%)	Rose's	corresp.	average	breadth	at Molar I;	98	individuals					
May, 1910	exceeding	by	3.3	mm.	(17.1	%)	Elmgren's	corresp.	average	height;	6	individuals	of	19	years			68.76
Height of Palate	"	"	3.2	"	(16.6	%)	Merkel's	"	"	"	106	"		15-20	"			68.39
(Model VII)	"	"	4.9	"	(27.2	%)	Schau's	"	"	"								
Index 5.79	"	"	5.6	"	(32.9	%)	Alkan's	"	"	"	190	"		17-24	"			69.1

Upper alveolar radius (according to Broca) exceeding by 13.3 mm. (13.3%) G. Retzin's corresponding average; 25 individuals
Lower alveolar radius " " " " " 22.9 " (21.6%) " " " " "
Mental radius " " " " " 38.9 " (36.5%) " " " " "

May, 1910 Breadth of Teeth	The central's breadth	9 mm.	(9.2 mm.)	maximum according to Rose			8.46 mm.
	The six years molar's breadth	11.4 "		"	"	" "	10.52 "

Distance between the condyles	exceeding by	35.5 mm.	(29.5%)	Hallsten's average;	25	*Craniums*		
Distance between back lower jaw angles	"	" 26.1 "	(25.4%)	"	"	"	"	
Distance from back lower jaw angle to the condyle	"	" 31.6 "	(54.1%)	"	"	"	"	
Distance from back lower jaw angle to point of jaw	"	" 30.3 "	(33.0%)	"	"	"	"	
Measurement from one angle of the lower jaw to the other along the mandible's lower edge	"	" 101.2 "	(51.9%)	"	"	"	"	
The back lower jaw angle	"	" 6.1° "		"	"	"	"	

Distance Between the Teeth. Table II.

	April, 1906		June, 1907		April, 1908		October, 1908		May, 1909		Sept. 1909		May, 1910	
	Model I		*Model II*		*Model III*		*Model IV*		*Model V*		*Model VI*		*Model VII*	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Distance between the lower canines.	35		34.8		35.8		36.4		37		37		37.5	
Distance between the lower front bicuspids.	44.4		44.4		44.8		46.0		46.5		46.7		47.8	
Distance from the lower wisdom tooth to central incisor on the opposite side.		58.6		59		60.0		60.8		61.4		61.0		62.8
Distance from the upper incisors cutting edge to the lower incisors sagittally..	9.6		12.0		12.7		13.8		16.5		16.5		17	
Distance from the upper six years molar to the lower central incisors on the opposite side.	45.0	47.0	52.8	50.0	53.0	50.1	54.0	54.6	51.5	54.3	52.0	54.3	53.2	54.0
Distance from the upper six years molar to the lower canine on the same side.	36.0	30.2	37.5	33.8	37.5	33.7	39.0	34.0	40.0	36.0	40.6	36.0	42.8	34.6

Nerve Blocking.

By Bion R. East, D.D.S., Detroit, Mich.

Since Dioscrides of Anazarba in Cilicia, the body physician of Nero, wrote the first materia medica in the year 77-78 A. D., and described a local anesthetic in which the active agent seems to have been carbolic acid, man has been striving to find some method in which a drug or drugs could be used to eliminate pain.

It is small wonder that local anesthesia is not spoken of during the Middle Ages, when a mixture of vinegar and a certain stone which, due to the cold produced when applied to the skin, was the only method known.

Little is said of local anesthetics in medical literature until 1856-7, when Richet and Sir Ben Richardson made use of the evaporation of ether to produce local anesthesia, as is still practiced to a small extent to-day.

Early Use of Cocain.

In 1855 cocain was extracted from leaves of the cocoa plant, but its anesthetizing properties were not known until 1859, when Nieman noticed that when he held the leaves in his mouth his lips and tongue became numb. This may be said to be the beginning of local anesthesia; however, it was not until 1884 that cocain was used hypodermatically for local anesthesia. In this year Koller gave a demonstration before a congress of ophthalmologists in Europe of the properties of the remarkable drug. Its use became almost universal at once, and the much longed for panacea seemed to be found at last. With the slight pharmacological knowledge of cocain known at that time it is not startling that those using it were brought up with a start when the fatalities became known. Halsted in 1885 described a method of injecting cocain into the inferior dental nerve to produce anesthesia in an area removed from the immediate field of operation, and to him goes the honor of being the father of conductive anesthesia or nerve blocking.

The power of cocain to anesthetize was known to all, but its toxic effect soon became known, too, and the use of the drug fell into dis-

repute in the hands of the more careful operators, until Schleih introduced his method of infiltrating a weak solution of cocain through the tissue. Local anesthesia did not come into its glory until Braun combined the small dose of cocain with the extract of the suprarenal gland.

Cocain and Adrenalin or Suprarenin.

Cocain in combination with adrenalin or suprarenin is not without danger, as all of you who have great experience can testify. "In no instances is it justifiable to speak of cocain mixtures as harmless in their application; therefore, the greatest care is needed, as the effect of cocain on the entire organism, especially the central nervous system, must be realized constantly. I collected records of a great many cases in which serious sequelæ from this drug were noted, even disturbances of the functions of the brain in the form of sexual affections." (Ritter.)

Substitution for Cocain.

It is the result of cases such as Ritter has observed that has prompted the investigation of Von Heyden, who introduced Alpha and Beta eucain; Fourneau, stovain; Tauber, halocain; Giesel, tropocain, and Einhorn, novocain. These drugs have all been used as a substitution for cocain with more or less success, but all have their bad features with the exception of the last, novocain.

Novocain.

Novocain is a synthetic chemical, the hydrochloride of p. aminobenzoyldiethyleminoethalol, melting point 156 degrees C. It can be heated without harming to 120 degrees C. It dissolves in equal parts of cold water. Alkalies and their salts precipitate novocain in the form of an oil, which soon solidifies in the form of crystals.

This is true of cocain as well, and accounts for many failures with local anesthesia. (When syringes boiled in water containing sodium bicarbonate.) Novocain is non-irritating, rational doses having no effect upon the respiration or circulation. It does not destroy accommodations when placed in the eye, a fact of no interest to the dentist, but appreciated by the ophthalmologist.

Novocain, more than any other drug used as a local anesthetic, should be combined with an agent which has the property of contracting the blood vessels in the area of injection. When this is done the local anesthesia is increased, hemorrhage lessened and the toxic effect reduced to the minimum. These drugs are obtained from two sources, first, by the extraction of the active blood pressure principle of the suprarenal gland of the sheep. Second, by a process, the drug is prepared synthetically from chemicals. The later would appear to be the most desirable method,

as there would be less danger of contamination. Synthetic suprarenin is the most active chemical known, being active in such small proportions as 1 in 100,000. The high toxicity of suprarenin accounts for many unfavorable symptoms after a local anesthetic has been used which are usually charged to novocain or cocain.

Nerve Blocking.

For some cases of intra-oral surgery, cavity preparation and operations on the dental pulp, nerve blocking is indicated and can be used most advantageously.

Drugs.

The drugs and the solutions used as a vehicle for carrying the drugs into the tissue are most important. Cocain is still the drug indicated where nerve endings are being anesthetized, but where a nerve trunk is to be blocked a 2 per cent. solution of novocain is indicated. The novocain should be diluted to 2 per cent. by the addition of Ringer solution. To this solution is now added sufficient adrenalin or synthetic suprarenin to make the strength one in 2,500.

There is some question as to the relative stability of synthetic suprarenin and the animal product. It has been claimed that the synthetic preparation is the more resistant to heat; however, in some recent experiments carried on in the research laboratories of Parke, Davis & Co., it was found that adrenalin retained its properties when heated in a series of tests longer than did the synthetic preparation.

Whether you use adrenalin or the synthetic preparation does not matter as much as if you use one which is pure and free from deterioration. With this in view, a separate solution should be made for each injection, using drugs in the form of dispensing tablets. Suprarenin or adrenalin should not be kept in liquid form. If a tablet containing adrenalin or suprarenin appears discolored it should be discarded, as deterioration has taken place. A tablet containing sodium chloride should not be used, as the salt absorbs enough moisture from the atmosphere to deteriorate the adrenalin contained in the tablet if the bottle is not kept securely corked.

Normal Salt Solution not to be Used.

Any solution injected into the organism should be perfectly isotonic. This is an undebatable point; otherwise we have a disturbance in the cells and the result may be necrosis or some other unfavorable result. The solution used to dissolve the tablets should also be as near the formula of the blood plasma as possible. Normal salt solution (sodium chloride) does not meet this requirement, the

blood also containing the salts of calcium and potassium. It has been found that a turtle's heart will continue to beat for an indefinite period of time when placed in *aqua distilata,* but stops when placed in normal salt solution (sodium chloride), but when traces of calcium and potassium are added the heart will resume its beating. This seems to be proof enough that when the salts of sodium are unsupported by calcium and potassium they have a marked toxic action upon the organism. With this fact in mind, sodium chloride solution should not be used as a vehicle for conveying the local anesthetic into the organism. Ringer solution contains sodium and potassium chloride and sodium bicarbonate in the correct proportions. The bicarbonate should be eliminated, as novocain and cocain are incompatible with alkalis.

The calcium salts play a very important part in our health. They are absolutely necessary in small proportions to produce the clotting of the blood. I have not experienced post-operating hemorrhage after operating to the same extent since using modified Ringer's solution instead of sodium chloride for the injection. Phagocytosis is increased and not impaired, as in the case of sodium chloride. These facts play an important part in cases of infection where it has been found that the case heals more rapidly. Edema decreased and the patient generally toned by the addition of calcium ions to the injected solution.

Preparation of Solution.

Place the proper quantity of novocain and suprarenin in a sterile porcelain or silver evaporating dish and add sufficient Ringer solution to make a 2 per cent. solution of novocain (⅓ grain of novocain to 1 cc.). Place over flame and boil one minute. Draw into sterile syringe at once.

Instruments.

The syringe used should be easily sterilized and durable, having no leather or rubber washers or packing to contaminate the solution. I know of only two that fill these requirements: the Fisher and the Novo Special, manufactured by the Imperial Co. The needles used are most important. Many men prefer iridio-platinum needles; however, the writer prefers a sharp steel needle, such as the Schimmel.

Technique.

Nerve blocking is particularly adapted for use in the mandible. The teeth of the lower jaw are supplied with the sense of touch through the mandibular division of the fifth or trifacial nerve. This nerve communicates with the inferior teeth by passing through the inferior dental canal which runs inside the hard, non-porous body of the mandible nearly to the median line. This physical condition of the bone accounts for un-

successful efforts to anesthetize any of the six inferior posterior teeth by infiltrating a local anesthetic in the gum tissue around them. The inferior dental nerve enters the inferior dental canal at the inferior foramen on the lingual side of the ramus. At this point a proper quantity of local anesthetic will anesthetize the six posterior teeth in from five to twenty minutes time, the condition lasting from one to three hours, during which time cavities may be prepared and pulps removed painlessly. At times, when operating upon molars, anesthesia will not be complete, due to communication through the buccinator nerve. A few drops of anesthetic placed in the buccal gum will overcome this. If anesthesia of bicuspids and cuspids is not complete after an injection into the pterygo-mandibular space, an injection into the mental foramen on the *opposite* side is required. For anesthesia of all the inferior teeth, inject into each inferior dental foramen.

Technique for Injection into Inferior Dental Foramen.

Wash or spray mouth with an antiseptic; touch the mucous membrane with iodin at the point of the needle's entrance. This point is just back of and one-third inch above the last molar. Place the syringe over the first bicuspid on the opposite side of the jaw and insert the needle at the point prepared until the internal oblique line is felt, then follow the bone as closely as possible until the needle has been inserted nearly to the hub (the needle being one and five-eighths inches, Schimmel). At this point deposit 2 cc. of the solution, blocking the lingual nerve.

Technique of Mental Injection.

The mouth is prepared as before. Insert the needle at the muscle line below the first bicuspid, going down and slightly back, depositing one cc. of a 2 per cent. solution. When the lip on the side of the pterygo-mandibular injection becomes anesthetized, it is safe to begin operating on the teeth. Always caution children against biting their lips, as they may injure the tissues without pain to themselves. The four inferior incisors may be anesthetized by infiltrating one cc. of a 2 per cent. solution near the apex of the tooth to be operated upon on the labial side.

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